

OCT 26 1960

CANADIAN ELECTRONICS ENGINEERING

OCTOBER 1960

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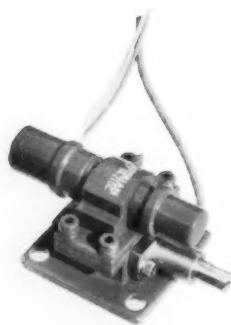
Queen Elizabeth Hotel, Montreal

IRE Communications Symposium

November 4-5, 1960

NUMBER **2** of a series

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CANADIAN ELECTRONICS ENGINEERING

Volume four, number

October 1960

IRE Symposium on Communications

Queen Elizabeth Hotel, Montreal — Nov. 4-5, 1960 — Sponsored by Montreal Section, Institute of Radio Engineers

| | |
|--|-----|
| General information about the symposium | 51 |
| Message from Dr. R. L. McFarlan, President IRE | 52 |
| Schedule of technical sessions | 53 |
| Summaries of technical papers | 54 |
| Floor plan and list of exhibitors | 72 |
| What the exhibitors are showing | 73 |
| New products on display | 75 |
| Advance registration and hotel reservation cards | 105 |

Departments

| | | | |
|---------------------------|----|------------------------------|-----|
| News highlights | 5 | For your library | 82 |
| People in the industry | 7 | Controls and instrumentation | 83 |
| Reports from the industry | 9 | Defense contracts | 88 |
| What's new in view | 76 | Advertisers' index | 103 |
| CAMESA News | 78 | Round-up: coming events | 104 |

CANADIAN ELECTRONICS ENGINEERING

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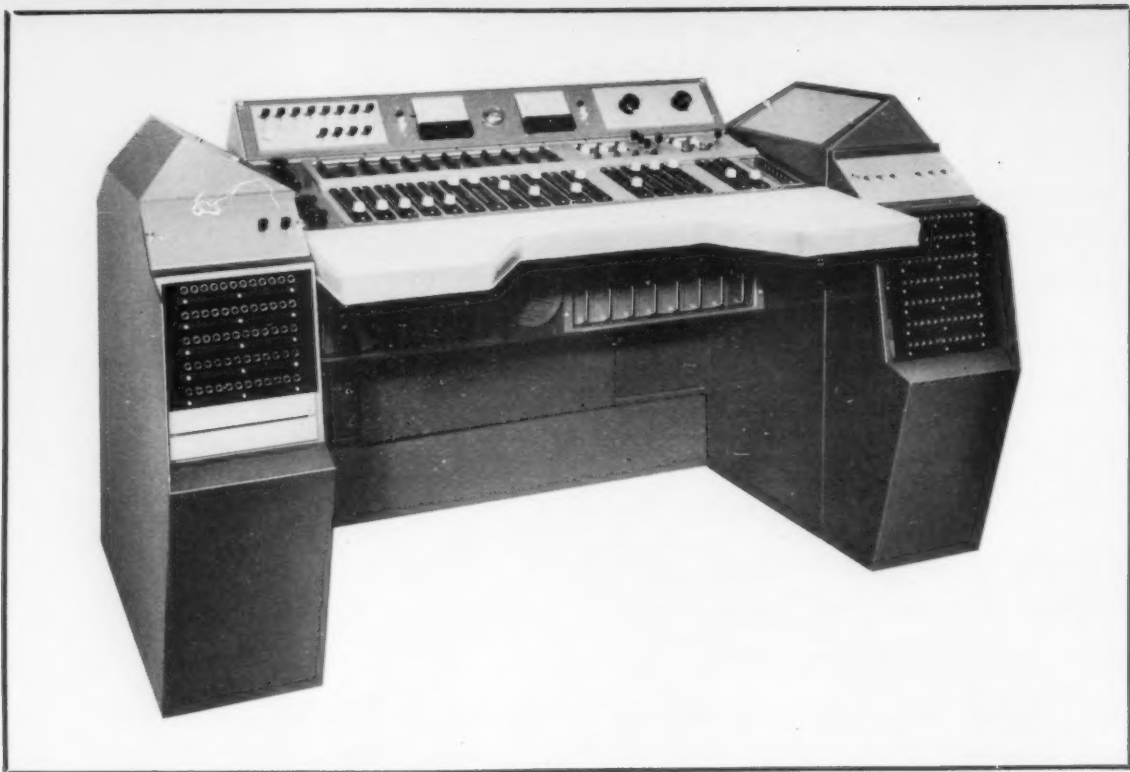
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The SS4500 and SS4600 TV Audio Control Consoles are the most recent additions to the family of integrated studio control systems pioneered by McCurdy Radio Industries. The new consoles provide complete audio distribution and control facilities for television programming, and are designed for maximum operating efficiency and convenience.

The SS4600, shown above, accepts up to twelve simultaneous inputs, which may be fed singly or in any combination to two master outputs, either directly or via three sub-master channels. Crosspoint switching of all sub-master and master inputs, plus complete jackfield facilities, results in extreme flexibility and permits an almost limitless number of input-output configurations. Two-position input keys on all channels provide for selection of the twelve inputs from a total of twenty-four prearranged sources.

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You are cordially invited to inspect the SS4500 and SS4600 at the I.R.E. Communications Symposium in Montreal, on November 4th and 5th, 1960,



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Typical specifications incorporating desirable features of a 3rd overtone crystal in the frequency ranges 25.0 mc/s to 60.0 mc/s:

Frequency tolerance:

$\pm .001\%$ of nominal at oven temperature.

$\pm .0005\%$ from frequency measured at oven temperature over the range $\pm 5^{\circ}\text{C}$ but within overall tolerance of $\pm .001\%$.

$\pm .0035\%$ frequency change over temperature range -55°C to $+105^{\circ}\text{C}$ not including finish tolerance.

Effective series resistance:
40 Ohms maximum.

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3.0 uuf to 7.0 uuf, depending upon customer specifications.

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Spurious response displayed by crystal

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Environmental Conditions:

Operating temperature range oven controlled $\pm 5^{\circ}\text{C}$.

Operable temperature range -55°C to $+105^{\circ}\text{C} \pm 2^{\circ}\text{C}$.

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long term: 10.0 ppm when held at $+105^{\circ}\text{C}$ for period of 200 days.

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and design**

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INSTRUMENTS

ALDEN



Plug-in components for electronic systems

Alden plug-in components offer far more than the convenience and ease of modular packaging . . . the prime advantage of these basic building blocks is that they make possible **more reliability in service.**

More in-service reliability through:



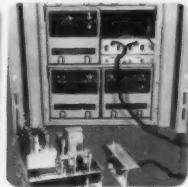
Tell-tale monitoring — all controls easily accessible, up front. Tiny tell-tales spot trouble instantly, isolate it to a specific modular unit.



Quick removal — malfunctioning unit can be removed with a half turn of the wrist, reducing down-time to 30 seconds with plug-in spare.



Quick replacement — malfunctioning component can be snapped out and replaced in seconds.



In-service checks — Alden Adapter Cable brings chassis out into the open while in operation for quick checking.



Single point of check — all leads brought to single checkpoint — makes possible color coded, vividly illustrated circuit legends.

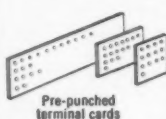


Quick repair — rugged, portable carrying case protects chassis. Replacement of malfunctioning chassis is only air mail time away from service center.

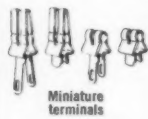
From layout to finished equipment...in just **3** steps:

1

Unitize circuitry in compact, vertical planes with Alden Terminal Card Mounting System — Your circuitry is assembled in complete units, ready for housing.



Pre-punched terminal cards



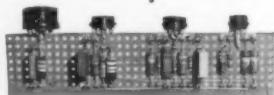
Miniature terminals



Jumper strip (eliminates wiring)



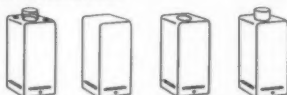
Card mounting sockets



Complete circuits ready for plug-in package or chassis

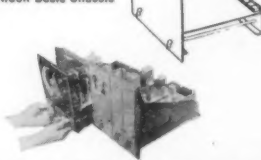
2

Mount cards in Alden Basic Chassis for tremendous variety with standard components — Alden provides standard plug-in or slide housings. With spares, units are replaceable in 30 seconds.



Alden plug-in package 4 sizes: 7, 9, 11, and 20 pin

Alden Basic Chassis



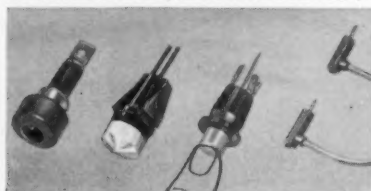
Picture Frame Rack Adaptor — for mounting Alden Basic Chassis in any combination. Mounts in standard rack or Alden UniRacks.

3

Mount sub-assemblies in Alden UniRacks — UniRacks fully utilize all the features of plug-in construction, give you a more compact, serviceable unit. Furnished in 2 basic heights, either mobile or stationary — easily accessible, front or rear.



Assign Alden testing and sensing elements to each unit to spot trouble instantly

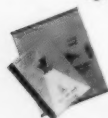


Miniature test jacks

Miniature indicator lights

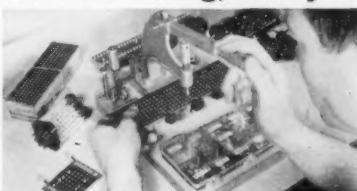
Miniature Pan-i-lite Switch (momentary contact)

Stacking and patch cord



Write today for new Alden Plug-in Booklet and handy, up-dated Quick Order Guide.

Two time saving, money saving, "GET STARTED" KITS



Terminal Card Mounting Kit #42 — Includes new Alden Staking Tool plus pre-punched terminal cards, ratchet terminals, eyelets, brackets, and card mounting tube sockets — everything for simplified, time saving circuitry layout.

\$49.95



Basic Chassis and Terminal Card Assortment Kit #37 — All necessary components to mount, house, fasten and monitor your electronic circuitry. Makes sense, save time, establishes reliability.

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Other kits from \$11.50

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See you at Booth 39
IRE Communication Symposium

NEWS HIGHLIGHTS

New Zealand and Canada now linked by international telex network

Prime Minister Walter Nash of New Zealand recently tapped out a message on a teleprinter machine located in Wellington to Prime Minister Diefenbaker, and thus began international telex service between the two countries. The trans-Pacific exchanges were put through the overseas telex board of Canadian Overseas Telecommunication Corporation. This marks the forty-seventh country in the world being served by telex from Canada.

CBC radio station CHAK at Inuvik will chalk up a number of "firsts"

The Canadian Broadcasting Corporation's newest and largest radio station in the Canadian north, CHAK, is expected to be on the air by November. Located at Inuvik, new town site of the former Aklavik in the Northwest Territories, the 1-kw station has been equipped by Canadian General Electric Co. Ltd. It will be the northernmost broadcasting station in North America; the first CBC operation inside the Arctic Circle; and the first Canadian radio station to broadcast regularly in the Eskimo language.

"Industry should not become dependent on defence contracts"—O'Hurley

Speaking at the opening of Raytheon Canada's new plant, reported on page 9, the Honorable Raymond O'Hurley, Minister of Defence Production, issued this warning to Canadian industry: "My experience as Minister has made it clear to me that industry should not become wholly, or even mainly, dependent on

defence contracts — either for their plant loading or for their engineering growth. As far as possible, we try in the defence production program to plan ahead — to stabilize our demands on industry over the long run. However, there are bound to be short term fluctuations, since our demands at any given time must be governed by the requirements of the Armed Forces. What we want, in effect, is an industry with the greatest possible sources of strength independent of the defence program."

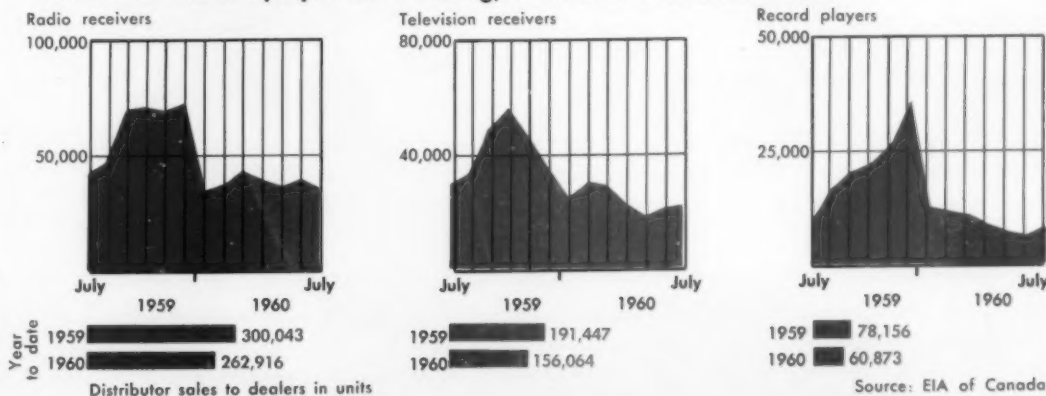
Yet another Canadian electronics firm builds its export business

One way of achieving the independence recommended by Mr. O'Hurley is activity in world commercial markets. The latest case to come to our attention is that of Stark Electronic Instruments Ltd. Following a 1958 agreement signed with Rocke International, a firm with over 100 offices throughout the world, Stark test equipment is now being sold in increasing quantities in Europe, South America, and Australia. Products include tube testers, oscilloscopes, vacuum-tube voltmeters, and signal generators.

NRC support for research at Canadian universities reached a record \$9.37 million in 1959-60

Figures released for the 43rd year of the National Research Council's foundation program show increases of \$2.62 million over 1958-59, and \$6.25 million over 1955-56. Direct research support in 1959-60 amounted to \$8,586,265. Seventy-seven percent of this was for studies in science and engineering, twenty-three percent for medical research.

Radio and record player sales firming, tv receivers continue decline





Announces expanded manufacturing and service facilities in new Canadian electronics plant

Raytheon has long been regarded as the symbol of excellence to Canadian users of electronic equipment and supplies... and their number is constantly growing.













New Canadian headquarters have been established in a modern 34,000 sq. ft. plant at Waterloo to produce and bring you Raytheon products quickly and efficiently, and to provide information and service on the application of these products.

Every facet of the engineering knowledge and exacting quality control in manufacture that have brought recognition to the name Raytheon, is reflected in our new plant facilities and personnel.

Examples of Raytheon electronic equipment are shown here. Address your enquiries to Commercial Sales Division, Raytheon Canada Limited, Waterloo, Ontario.



Some of the products we supply:

 *Semi-conductors—Transistors, Diodes and Rectifiers*
 *Industrial and special purpose tubes in a wide range*
 *Microwave and Power Tubes*
 *Machlett Power Tubes*
 *Microwave Communication Systems*
 *Welding Equipment*
 *Ultrasonic Machine Tools*
 *Knobs and Captive Hardware*
 *Transformers, Rectichargers and special telephone switchboard battery chargers*
 *Radarange Electronic Ovens*
 *Marine Radar*
 *Fathometer Depth Sounders*



excellence in electronics

RAYTHEON CANADA LIMITED
WATERLOO ONTARIO

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People in the industry

E. W. Leaver named a director of American Management Assoc.

The American Management Assoc. has elected a director from Canada. He is **E. W. Leaver**, president of Electronic Associates Ltd., Willowdale, Ont.

Mr. Leaver has been active in AMA affairs and formerly served on its Planning Council. He has also participated in a number of panel discussions and seminars on business management, particularly in the field of automatic control.

Mr. Leaver served with Research Enterprises Ltd., and National Research Council during World War 2. In 1946 he joined with G. R. Mounce to found Electronic Associates Ltd., a company producing industrial electronic equipment and nuclear instruments.

Probably the first article ever published on the subject of automation was written by Mr. Leaver and Dr. J. J. Brown. It was entitled "Machines without men" and was printed by Fortune magazine.

Watler becomes general manager of Muirhead Instruments Ltd.

A. J. Muirhead, executive vice-president of Muirhead Instruments Ltd., Stratford, Ont., has announced the appointment of **R. W. Watler, P.Eng.**, as general manager.

Before coming to Canada in 1958 Mr. Watler spent eight years with the parent company in Beckenham, England. Engaged originally in the design, development and testing of control equipment for ship stabilization, he was later appointed servo systems engineer. In this capacity he traveled widely throughout the world on company business.

New accountant at Muirhead In-

struments Ltd. is **R. G. Roth, B.A., C.A.** He joined the company in March of this year, shortly after qualifying as a Chartered Accountant.

Union Carbide appoints silicones tech. rep.

Assigned as a Silicones Technical Representative to the Eastern Sales District of Union Carbide Canada Ltd., Bakelite Division is **Robert John French**. He will be located in the company's Montreal office at 1255 Laird Blvd., Town of Mount Royal, Montreal 16.

Mr. French graduated from Sir George Williams College in 1950, and has gained a thorough technical background in industry in Eastern Canada. He has also completed an extensive training program at the research laboratories of the Silicones Division of Union Carbide Corporation at Townawanda, N.Y.

University of Toronto staff news

Professor J. Ham has taken a year's leave of absence from University of Toronto, Electrical Engineering Dept. to study at Cambridge University, England. He will work with J. F. Coales, Reader in the Engineering Laboratory.

Professor Ham recently returned from the U.S.S.R. where he spent eight weeks on an exchange program sponsored by National Research Council. While in Moscow, Professor Ham attended the First International Congress for Automatic Control, sponsored by the International Federation of Automatic Control.

Dr. R. J. Kavanagh has been ap-

pointed assistant professor in Dept. of Electrical Engineering. He is a graduate of the University of New Brunswick (BSc) and Toronto (MSc and PhD). He held positions on the staff of the University of Toronto from 1953-59, and spent last year at Imperial College, London, on an NRC post-doctorate fellowship. His field of interest is feedback control systems.

Other promotions at Toronto include **I. I. Glass** (Aerophysics) to the rank of professor; **G. K. Korbacher** (Aerophysics) to the rank of associate professor; and **I. McCausland** (Electrical Engineering) to the rank of assistant professor.

New general manager at F. J. Stokes Co.

The appointment of **Roy D. Wilson** as general manager of F. J. Stokes Co. of Canada Ltd. has been announced by **A. A. Hutchings**, vice-president.

Mr. Wilson, sales engineer for Stokes of Canada since 1958, was previously a design engineer for Purolator Products (Canada) Ltd. and an industrial engineer for Gair Co. (Canada) Ltd. He is a native of Toronto, and received his BSc from U of T in 1953.

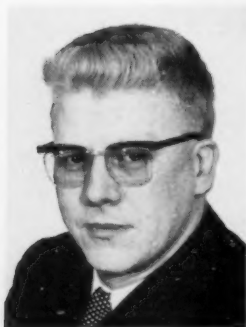
Honeywell Controls add to board

The election of **Leonard F. Wills**, vice-president and general manager, to the board of directors of Honeywell Controls Ltd., Toronto, has been announced by **W. H. Evans**, president.

Mr. Wills joined the company in 1932. He was appointed manager of manufacturing in 1948 and became a vice-president in 1958.

Manager of Montreal sales branch

Canadian Admiral Corp. Ltd. has appointed **J. Albert Reed** as manager of its Montreal sales branch. He has been with the company since 1952, first as sales representative, then sales manager of the Montreal branch.



Leaver



Watler



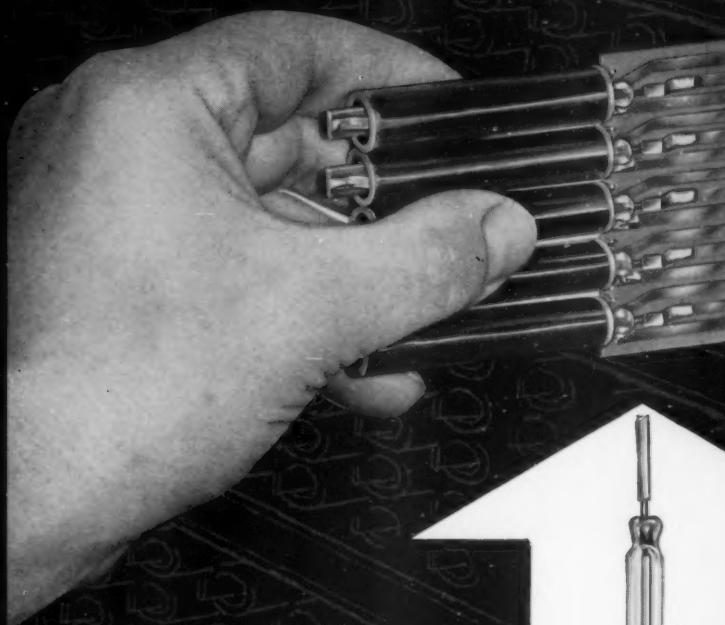
Roth



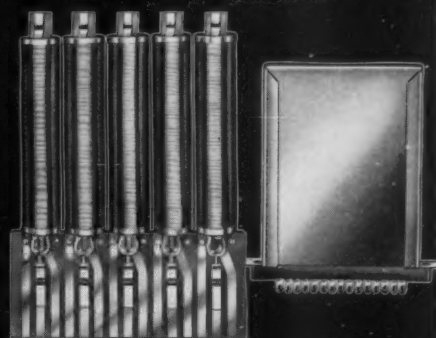
French

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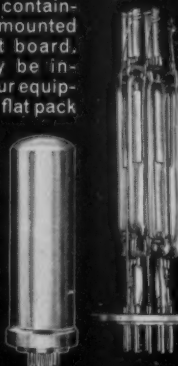


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Here five relays, each containing two switches, are mounted on a printed circuit board. This assembly may be inserted directly into your equipment or enclosed in a flat pack container.

These six switches are clustered to form the core of a single electromagnetic coil, and encased in a cylindrical steel container.



ACTUAL SIZE

Basic element of CLAREED relays is this switch capsule. A pair of magnetically operated contacts is hermetically sealed in an atmosphere of inert gas. The capsule combines extreme simplicity with high reliability and long life. It has excellent low-level characteristics.



CLAREED Sealed Contact Reed relays put you . . . the designer . . . in the driver's seat. They are simple in design, flexible in assembly. They are packaged and mounted to comply with *your* mechanical design configuration . . . even on your own circuit board. CLAREED relays are ideal components for transistor-drive applications, computers, data-processing and other high speed equipment.

Contacts are hermetically sealed in inert gas. Tens of millions of operations are assured since contact contamination is completely precluded. Hundreds of millions of operations are possible when operated up to ½ rated load.

If you use relays, it will pay you to know all about CLAREED . . . an entirely new concept in relay design. Address C. P. Clare & Co., 3101 Pratt Blvd., Chicago 45, Illinois. In Canada: C. P. Clare Canada Limited, Box 134, Downsview, Ontario. Cable Address: CLARELAY. Send for Bulletin CPC-5.

CLARE

When only the best is good enough

Raytheon Canada Limited opens new plant at Waterloo, Ontario

A new electronics plant was dedicated at Waterloo, Ontario last month by the Honorable Raymond O'Hurley, Minister of Defence Production, with the official opening of Raytheon Canada Limited's new headquarters.

Built to house the expanding activities of the firm, the new 34,000 square-foot, single-storied brick headquarters combines under a single roof the marketing, engineering, production, sales and management functions formerly located in three separate sites in the Kitchener-Waterloo area.

Located on a 25-acre tract, the \$400,000 building investment is the latest milestone in Raytheon Canada's rapid progress, said John R. Cann, executive vice-president and general manager. Formed in 1956 with only three employees, the firm now has 190 employees with a \$650,000 pay-roll and multi-million dollar sales.

Products have included air traffic surveillance radars for DOT; an associated bright display system; transistorized ppi's for the SAGE system; sector scan displays, and true and relative bearing indicators for the U. S. Navy.

Raytheon Canada also announced last month that it has produced and will supervise the installation of two long-range surveillance radars for Switzerland. The company has also produced this system for Lebanon.



Raytheon Canada Limited employee makes final cable adjustment to Bright Display system, which permits air traffic controllers to view surveillance radar information on tv monitors in full daylight.

McGraw-Edison (Canada) Ltd. announces new division

Directors and management of the eleven American divisions of McGraw-Edison Co., Elgin, Ill., held their first meetings outside the United States in Toronto during August.

A meeting was also held of the directors of McGraw-Edison (Canada) Ltd., following which it was announced that **National Electric Coil Co.** of St. John's, Que., manufacturer of coils and electrical equipment is to become the fourth division of the Canadian company.

Canadian Geloso Electronics Ltd. formed

Under the leadership of Mr. A. T. R. Armstrong, Canadian Geloso Electronics Ltd. has been formed, with headquarters at 700 Weston Rd., Toronto 9. The new firm will sell and promote the products of SPA Geloso of Milan, Italy, including StenOtape dictating machines, tape recorders, amateur transmitters and receivers, am/fm radios, fm tuners, and some electronic components.

Mincom tape recorders available from 3M

Broad-band, multi-track, analog, magnetic tape recorders for research, telemetering, and other electronic applications are now being handled in Canada by the Electrical Products Division of Minnesota Mining and Manufacturing of Canada Ltd., London, Ont. These specialized recorders are manufactured by the parent company's Mincom Division, formerly the electronics division of Bing Crosby Enterprises, located in Los Angeles.

Manufacturers appoint representatives

Owen Laboratories Inc. of Pasadena, Calif. have appointed **Mel Sales Ltd.**, Toronto and Montreal, as exclusive sales rep. in Canada (laboratory semiconductor test sets, precision programmed reference voltage supplies, transducer support equipment).

Paisley Products of Canada Ltd., Scarborough, Ont. and Montreal, are now sole distributor for London Chemical Co. of Chicago, Ill. (wire strippers, solder fluxes, cleaning compounds, protective coatings).

(Continued on page 80)

Ottawa report

Delicate and difficult negotiations are going on here between officials of the Canadian and Japanese governments trying to find an acceptable level for import quotas on Japanese electronic tubes.

Meanwhile, at another level the National Revenue Department is studying a report from its officer in Tokyo on the cost structure of the Japanese industry. This is intended as a check on current valuations for duty purposes on the imported tubes.

This report is now being studied by the Department. Sources report it contains evidence that would warrant sizeable increases in valuations which would in turn mean higher duty rates. Recommendations from the Revenue Department will be available for the government to take action before the end of October.

But the most important activities are those of Finance Department officials and members of the Japanese Embassy here.

Initial proposal to the Japanese was an import limit of 10% of the Canadian market. This would constitute about 1,800,000 receiving tubes, a definite decline from Japanese exports to Canada of 2,205,000 tubes in 1959.

Since 1959, however, the picture has become further complicated by the entry of another major Japanese producer into the Canadian market. In 1959 one company alone, Hitachi, provided 90% of the imports. But since last spring, under a deal with Canadian Marconi Company, another firm, Toshiba, has been shipping over large quantities. Total Japanese tube sales this year should top 4,000,000.

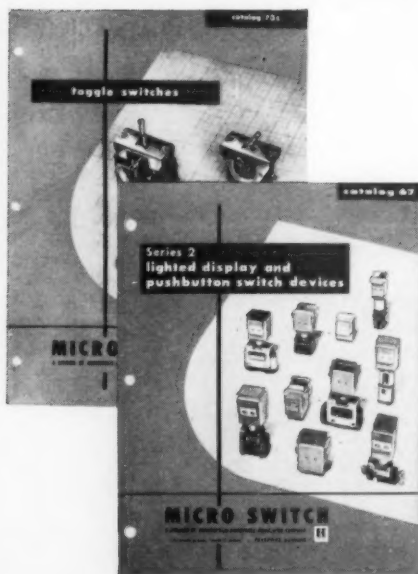
Entry of Toshiba into the Canadian market has made it harder to secure agreement among Japanese manufacturers, sources here report. Representatives of the Japanese industry were here last August for talks with Canadian industry representatives and the hope of the Japanese government is that it can be settled on an industry basis. Finance Department officials, however, are working on the assumption that an agreement can only come on a government level.

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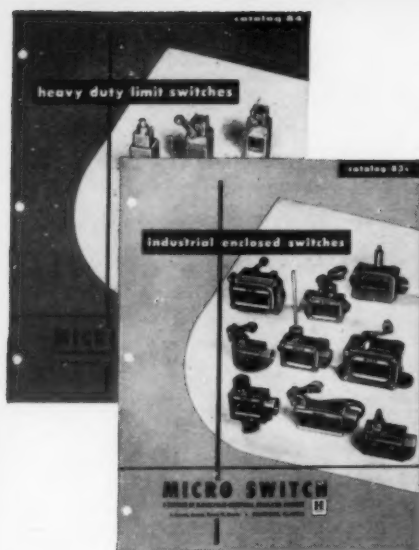
BASIC AIRBORNE SWITCHES are specially designed for use in airborne applications and can be installed in many different combinations of circuit, actuator and housing requirements. In addition, the characteristics of many of these switches make them suitable for use in automotive, transport or marine applications. Write for Catalogue 78.

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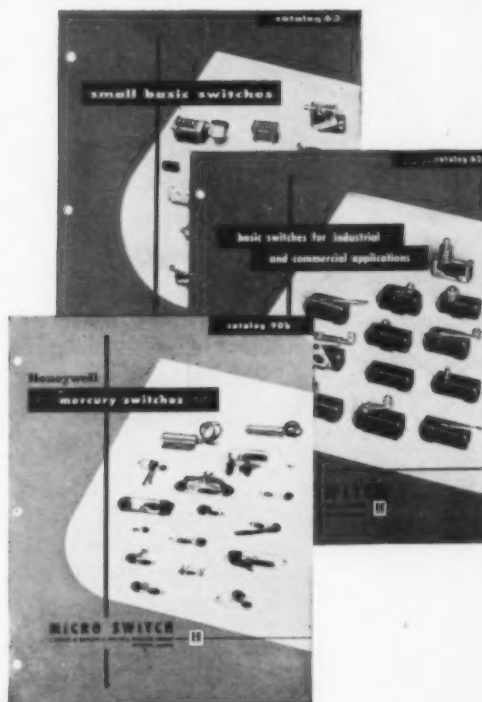
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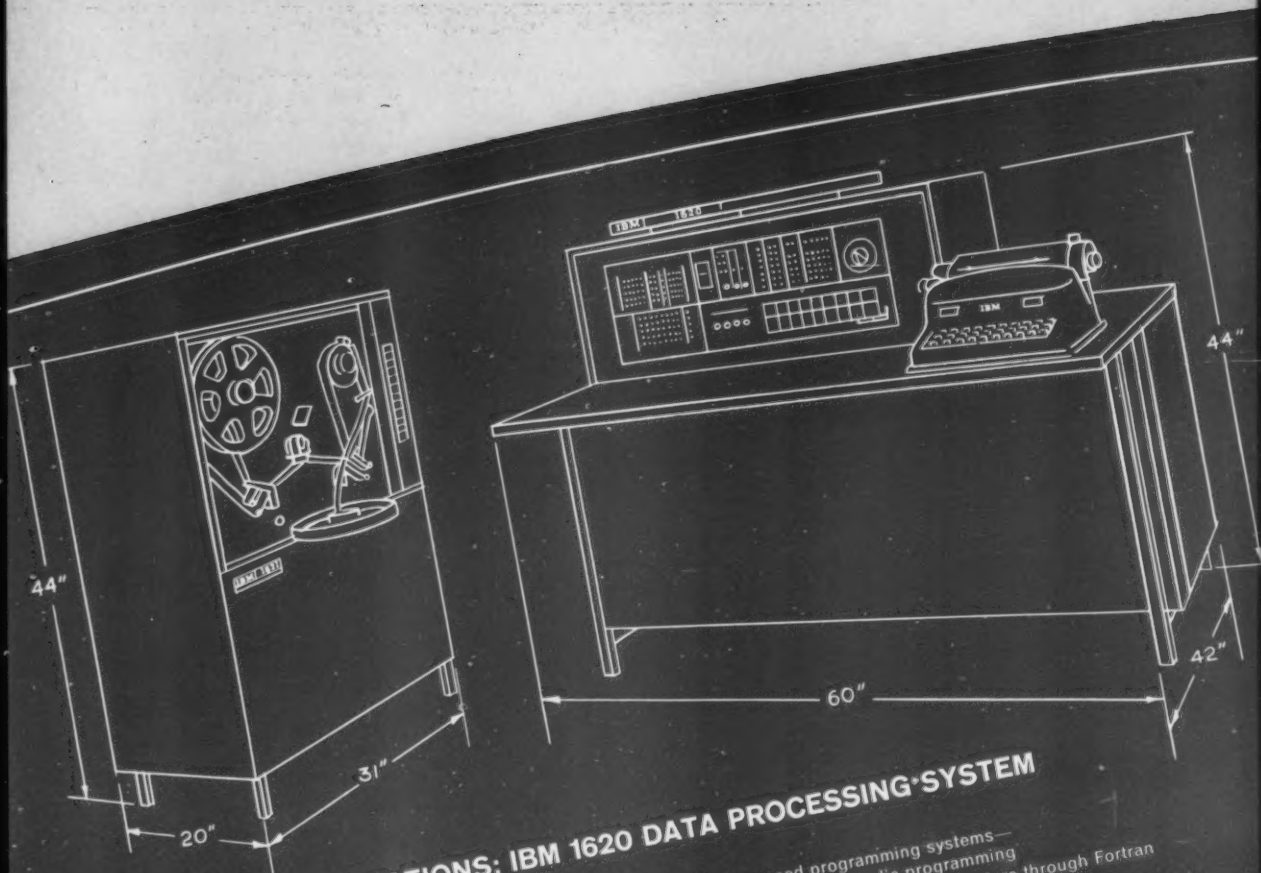


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| Machine | Weight in lbs. | Current Requirements | Power cord | Interconnecting cable | Heat Load Specification BTU/Hr |
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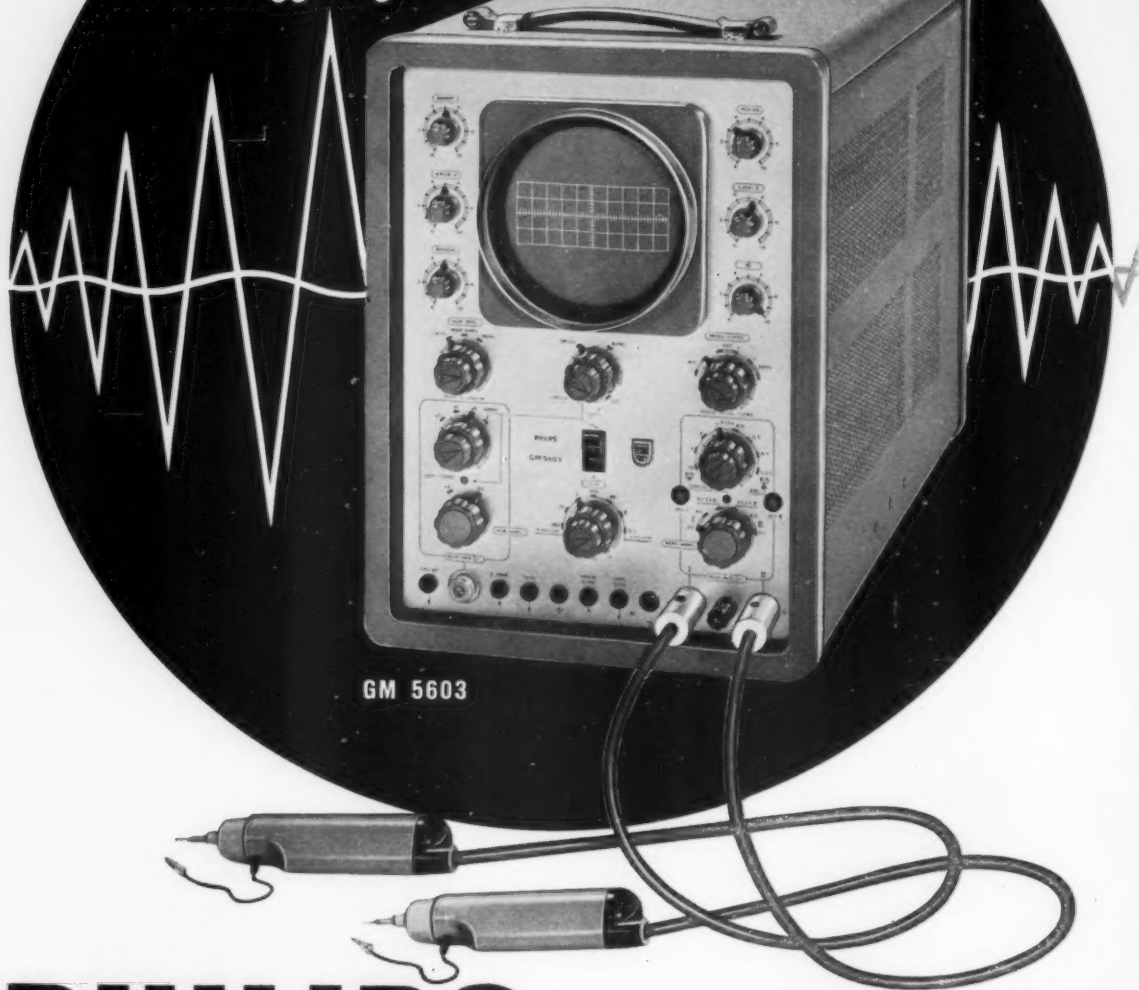
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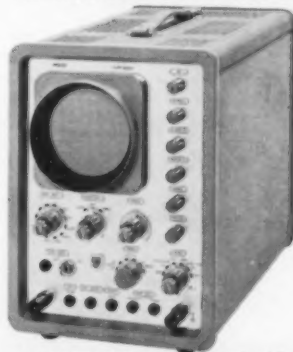
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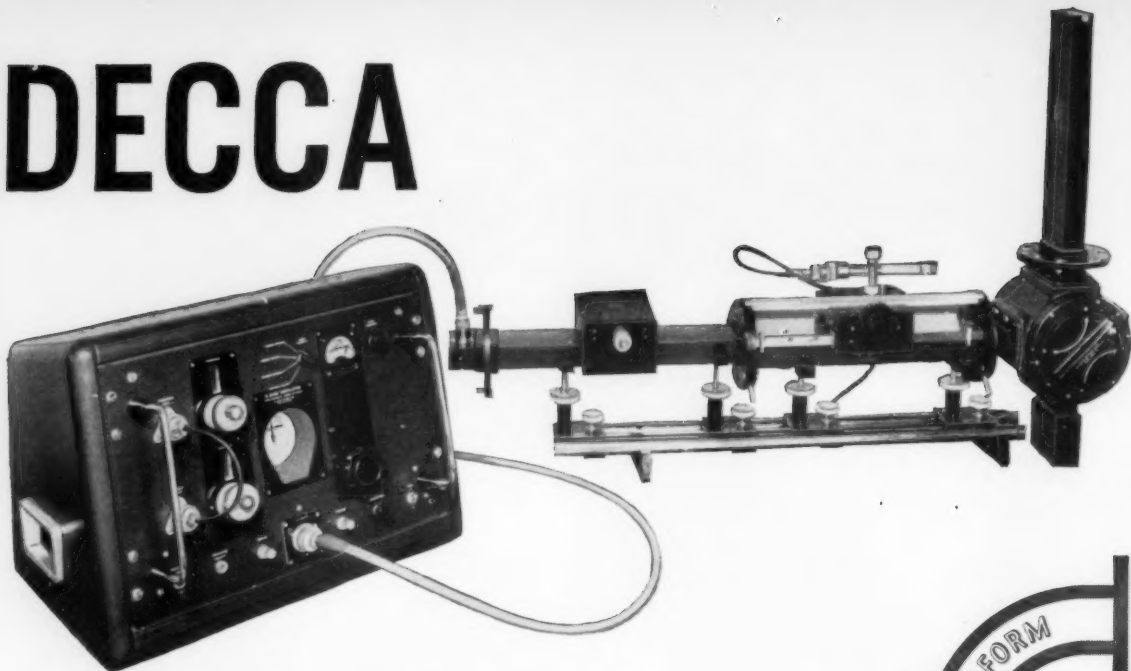
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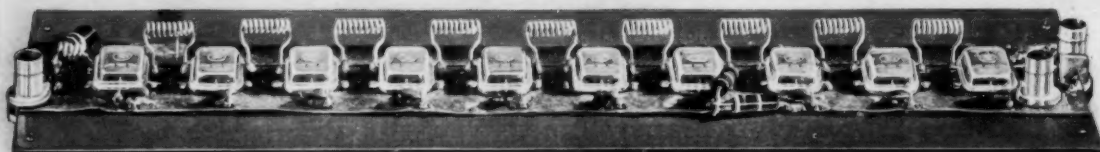
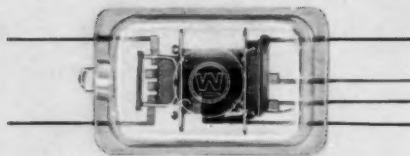
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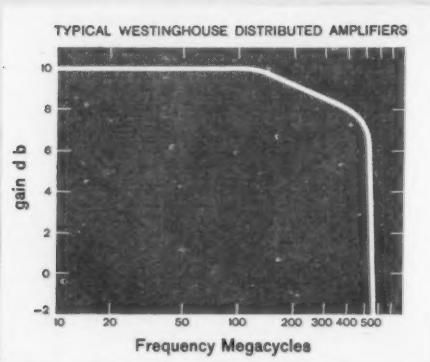
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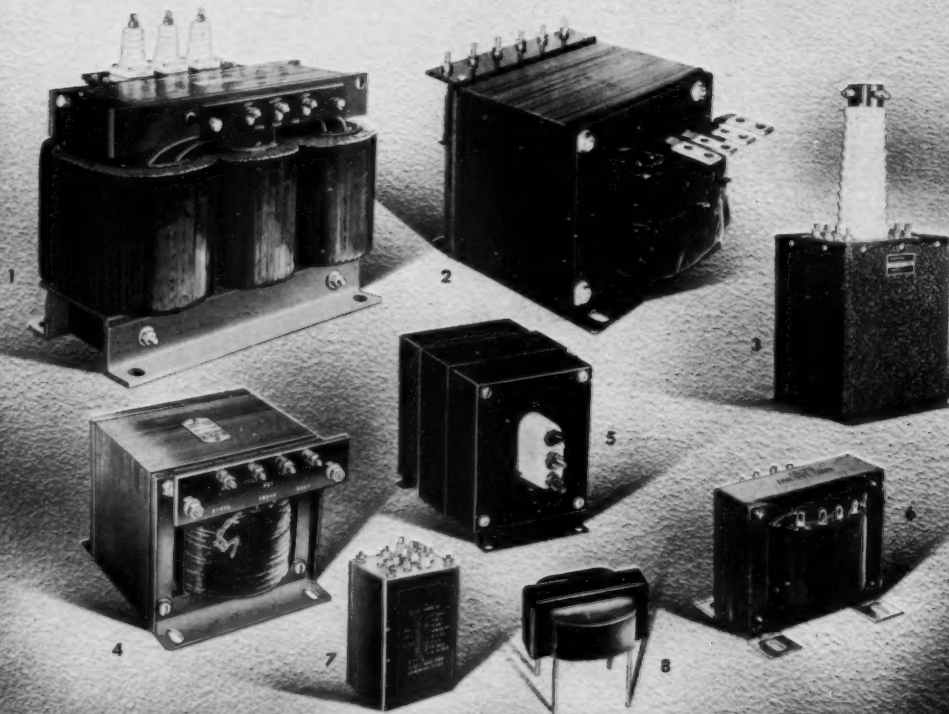
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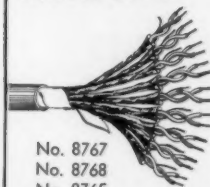
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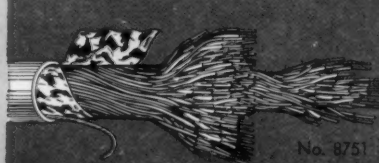


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(Characteristics "V" and "G")



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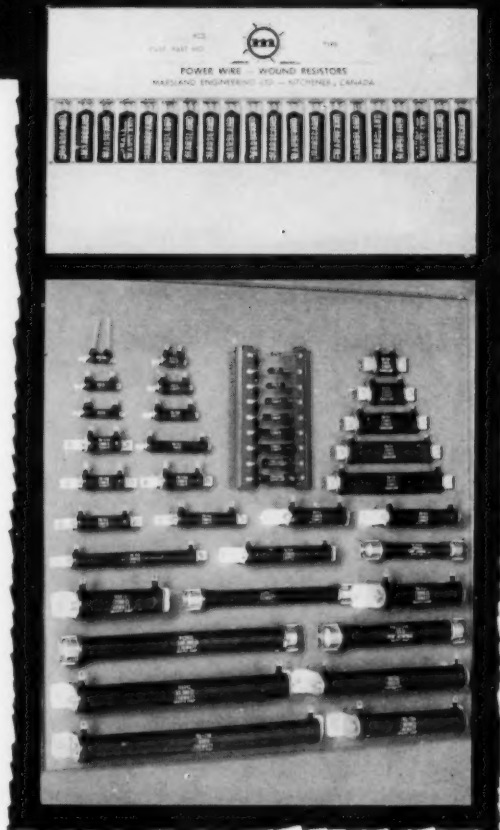
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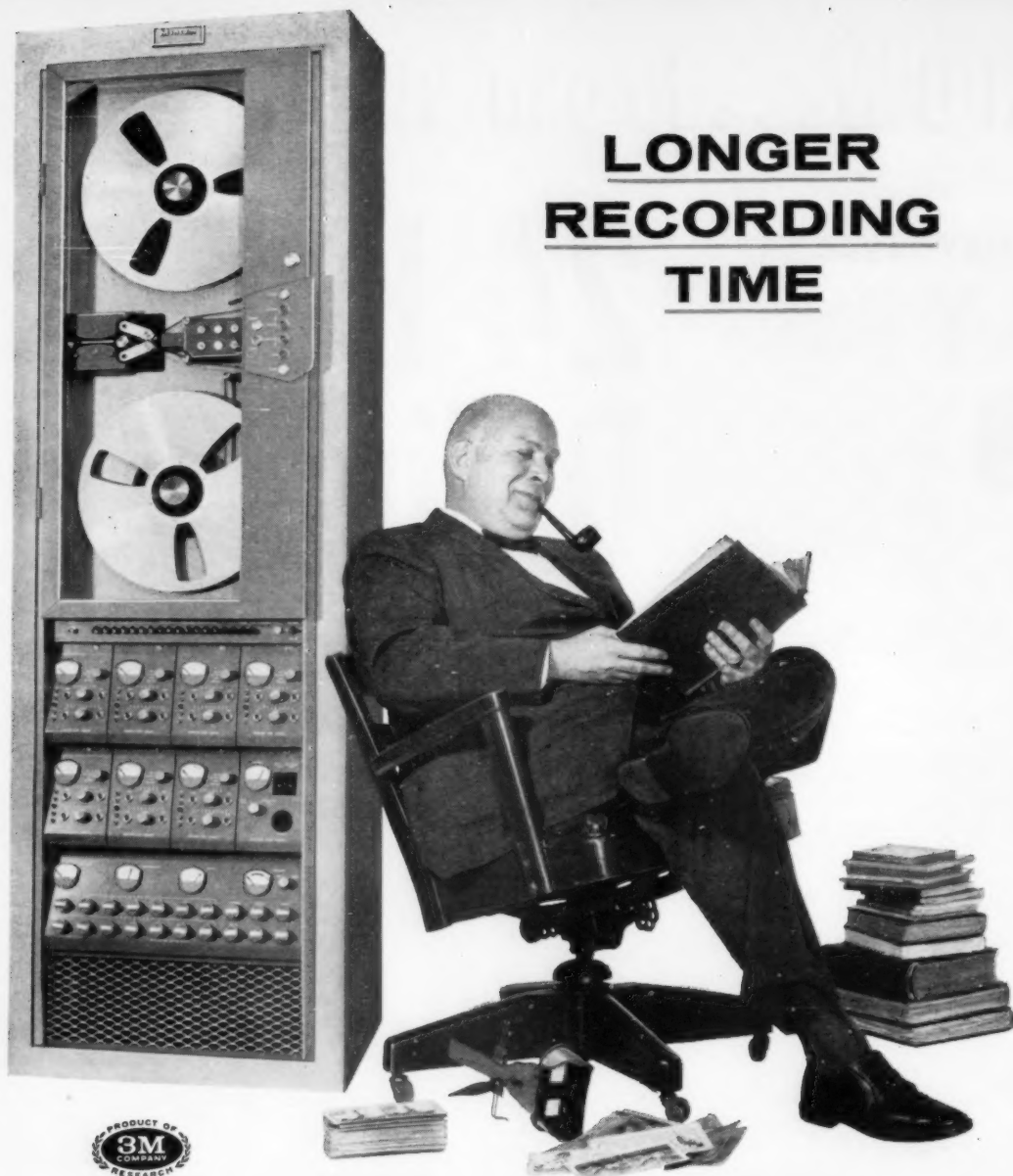
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LONGER RECORDING TIME



Longer recording time because of higher tape packing density at all six speeds—from 3 hours and 12 minutes at 62.5 kc—7½ ips, to 12 minutes recording 1 mc—120 ips. That's only one advantage of the new Mincom Model CM-100 Magnetic Tape Instrumentation Recorder/Reproducer. Read on: CM-100, an analog system, does the work of two systems by storing both analog and pulse data simultaneously and with equal facility. Also: One-rack compactness, no belt changes, all-dynamic braking, seven 1 mc tracks on ½-inch tape, built-in calibration, IRIG compatibility, only twelve moving parts with four easy adjustments. Interested? Write today for brochure.

62.5 KC—7½ IPS—192 MIN • 100 KC—12 IPS—120 MIN • 125 KC—15 IPS—96 MIN • 250 KC—30 IPS—48 MIN • 500 KC—60 IPS—24 MIN
1 MC—120 IPS—12 MIN

MINCOM DIVISION OF MINNESOTA MINING AND MANUFACTURING COMPANY
represented in Canada by

MINNESOTA MINING AND MANUFACTURING OF CANADA LIMITED
LONDON, ONTARIO

For further information mark No. 66 on Readers' Service Card

CANADIAN ELECTRONICS ENGINEERING, OCTOBER, 1960

A STAKE IN CANADA

Northern's manufacturing plants, warehouses and offices in many cities across the Dominion represent a great investment in Canada. This brings to each community revenue in taxes and the purchasing power of Northern Electric employees.* This investment continues to grow with the growth of the Company.

Northern Electric designs, manufactures and installs a large proportion of Canada's telephone communication systems and equipment. This experience is invaluable in the development of materials and systems for Canada's Defence Communications. Northern Electric also produces all types of electrical wires and cables for communication and power transmission.

At Northern Electric, product research and development never stops and advances are continually being made.



BELLEVILLE, ONT. — COMMUNICATIONS EQUIPMENT DIVISION
Floor Area — 188,000 sq. ft.
Employees — 900

MONTREAL, P.Q. — COMMUNICATIONS EQUIPMENT DIVISION
Floor Area — 1,620,000 sq. ft.
Employees — 7,950

LACHINE, P.Q. — WIRE AND CABLE DIVISION
Floor Area — 950,000 sq. ft.
Employees — 1,850

LONDON, ONT. — COMMUNICATIONS EQUIPMENT DIVISION
Floor Area — 317,000 sq. ft.
Employees — 200
(Ultimately, 1,000)

*Total including employees in Sales Division, Telephone Contract Division, Installation Department, Research and Development Department and Headquarters staff, 15,300.



Northern Electric

COMPANY LIMITED

SERVES YOU BEST

Even in high-frequency and rapid-switching types...



PHILCO OFFERS YOU

THE COMPLETE AND



COMPLETELY RELIABLE

LINE OF TRANSISTORS:



Whatever the type of transistor you require — however demanding the application — you can fill your requirements from the complete, reliably-built line of Philco transistors.

This table shows a typical assortment of Philco transistors. The line also includes high-frequency and rapid-switching types, in the successful development of which Philco engineers have led the industry.

VHF-UHF Microalloy diffused base (MADT) types:

2N502, 2N501, 2N499, 2N504

High-frequency Microalloy types:

2N393, 2N599, 2N600

Medium-powered alloy junction types:

2N1125

High-powered alloy junction types:

2N386, 2N387

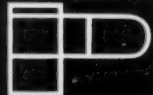
MAIL THE COUPON BELOW FOR FURTHER DETAILS

Philco Corporation of Canada
Don Mills, Ontario.

NAME

ADDRESS

60-10-CEE



PHILCO

*government and
industrial dept.*

PHILCO CORPORATION OF CANADA LIMITED, DON MILLS, ONTARIO

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CANADIAN ELECTRONICS ENGINEERING OCTOBER 1960

the new generation of **MAGNET WIRES**

It could be that there is a *better* type of magnet wire available for your use today, than the type now being used. Modern technology has created an impressive number of new types of magnet wires.

Canada Wire is making *all* types, so Canada Wire is best equipped to advise you. Call your nearest Canada Wire sales office and discuss your problem. The result could be profitable for you.

FORMEL

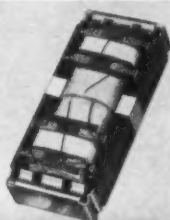
The best general purpose magnet wire now being manufactured. It is a vinyl acetal coated wire that has many outstanding properties for use in equipment functioning at temperatures not exceeding 105°C.



Fan Motor Stator Winding

NYLON

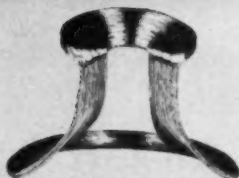
A polamide coating wire characterized by excellent windability and ability to solder in dip operations at temperatures of 650°F. to 750°F. without prior removal of coating.



Fluorescent Lamp Ballast Transformer Coil

BONDEL

A Formel insulated wire with a thermoplastic cement overcoat. This overcoat softens when exposed to heat (275°F.) or solvent (alcohol). Will bond the wires in a desired shape on cooling.



Deflection Yoke Coil for Television

POLYSOL

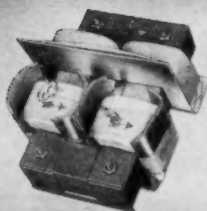
A modified isocyanate coated wire characterized by its excellent electrical properties (particularly at high frequencies) and its ability to solder in dip operations without prior removal of the insulation.



Electronic IF Transformer Coil

PLAIN ENAMEL C-90

Insulated with an oil resin varnish film. Provides outstanding electrical properties in very thin film build-ups.



Oil Burner Ignition Coil

POLYSOL-N

Polysol insulated with a nylon overcoat. Combines the excellent windability and solvent resistance of nylon with the outstanding electrical characteristics of polysol. For soldering in dip operations without prior removal of coating.



Automotive Generator Armature

QUALITY CABLE IS LOW COST CABLE

Canada Wire and Cable Company Limited

MAGNET WIRE DIVISION—SIMCOE, ONTARIO

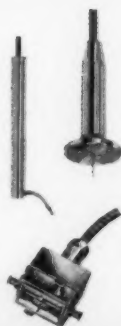
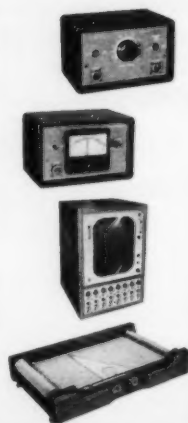
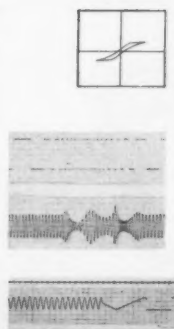
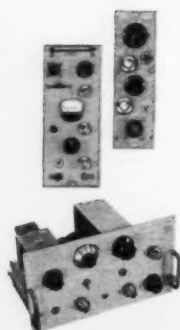
A Canadian Company Manufacturing and Selling Coast to Coast



40-61

FLEXIBLE "BUILDING BLOCKS" FROM SANBORN

meet **YOUR** oscillographic recording needs



INPUTS

**INTERCHANGEABLE
PLUG-IN PREAMPS**
"850", "350", "150" STYLE
Carrier . . . Phase Sensitive De-
modulator . . . DC Coupling . . .
Low Level types

"350", "150" STYLE
400 cycle Frequency Deviation
. . . Logarithmic types

"150" STYLE
AC-DC . . . AC Wattmeter . . .
RMS Volt/Ammeter . . . Fre-
quency Meter . . . Stabilized DC
. . . Triplexer types

SINGLE-CHASSIS 6- OR 8- CHANNEL AMPLIFIERS

"950" series high and low gain
types . . . "650" medium gain
type for Sanborn or other optical
recorders.

FREQUENCY RESPONSE (WRITING METHOD)

DC TO 150 CPS with heated
stylus traces on rectangular
coordinate charts.

DC TO 5000 CPS with new
"650" optical instant readout
recorder.

X-Y RECORDING at writing
speeds up to 2500"/sec with the
Model 670 optical X-Y recorder.

PACKAGING NO. OF CHANNELS

PORTABLES—single channel,
21-lb "brief case" systems—
either DC amplifier (Model 299)
or AC strain gage amplifier
(Model 301).

MODEL 320 separate DC am-
plifiers, 4-speeds, 50 mm wide
channels.

RACK-MOUNTED 2-channel
Model 297 system with plug-in
preamps. Mounts in 10 1/2" rack
space or separate portable case.

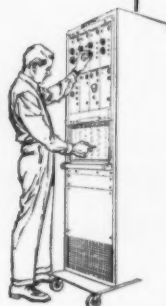
**1- TO 16-CHANNEL
MOBILE SYSTEMS**—"150",
"350" and "850" series with
plug-in preamps . . . "950" sys-
tem with 6- or 8-channel ampli-
fier . . . "650" system with 6- or
8-channel amplifier and optical
recorder.

ACCESSORIES

Chart Viewer . . . 8-channel, 17"
Monitoring Oscilloscope . . .
Monitor Meter . . . Phase Shifter
. . . 4- to 32-channel event
recorders.

TRANSDUCERS

For Linear displacement—
Linearsyn, Miniature "probe-
style" units . . . Linear velocity—
LVsyn, many standard or special
models . . . small, single-ended
or differential pressures—267,
268 Series.



Complete details of Sanborn recording instruments are available from Sanborn
Sales-Engineering representatives located in principal cities throughout the
United States, Canada and foreign countries . . . or write

SANBORN COMPANY INDUSTRIAL DIVISION

175 WYMAN STREET, WALTHAM 54, MASS.

For further information mark No. 86 on Readers' Service Card

CANADIAN ELECTRONICS ENGINEERING OCTOBER 1960

DESIGN WITH ARNOLD 6T CORES ... SAME-DAY SHIPMENT OF STANDARD DELTAMAX CORE SIZES

Arnold 6T tape cores (aluminum-cased and hermetically-sealed) offer you three very important design advantages. *One:* Maximum compactness, comparable to or exceeding that previously offered only by plastic-cased cores. *Two:* Maximum built-in protection against environmental hazards. *Three:* Require no supplementary insulation prior to winding and can be vacuum impregnated after winding.

Now we've added a fourth vital advantage: Maximum availability. An initial stock of approximately

20,000 Deltamax 1, 2 and 4-mil tape cores in the proposed EIA standard sizes (See AIEE Publication No. 430) is ready on warehouse shelves for your convenience. From this revolving stock, you can get immediate shipment (*the same day order is received*) on cores in quantities from prototype lots to regular production requirements.

Use Arnold 6T cores in your designs for improved performance and reduced cost. They're guaranteed against 1000-volt breakdown ... guaranteed to meet military

test specifications for resistance to vibration and shock ... guaranteed also to meet military specifications for operating temperatures. The 6T hermetic casing method is extra rigid to protect against strains.

Let us supply *your* requirements. Full data (Bulletin TC-101A and Supplements) on request. • Write *The Arnold Engineering Company, Main Office and Plant, Marengo, Ill.*

ADDRESS DEPT. CE-10

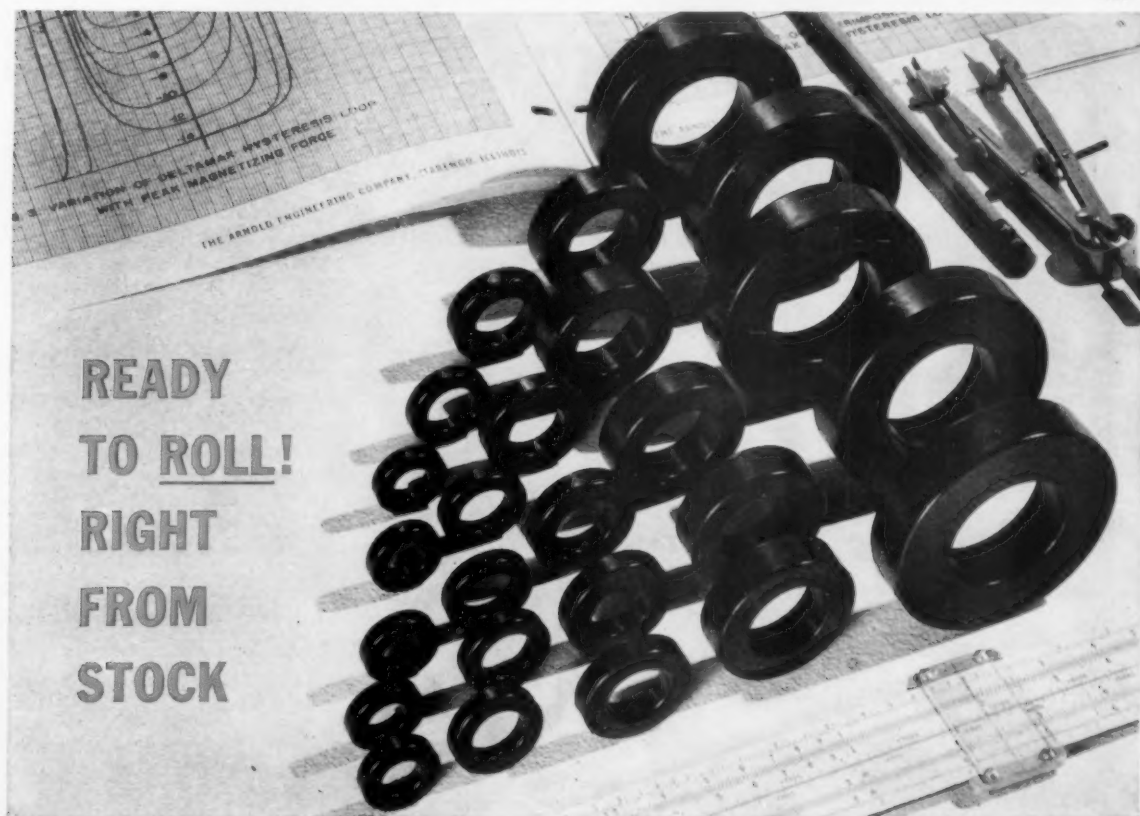


ARNOLD

SPECIALISTS in MAGNETIC MATERIALS

CANADIAN Representatives: Boyly Engineering Ltd., First St.,
Ajax, Ont. Telephone (Toronto Exchange): EMpire 2-3741

1030



READY
TO ROLL!
RIGHT
FROM
STOCK

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VIRTUALLY FREE FROM BANDWIDTH LIMITATIONS

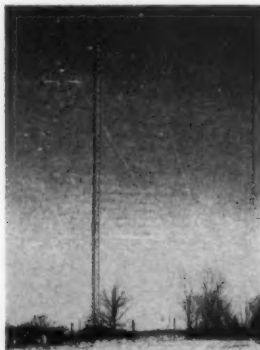
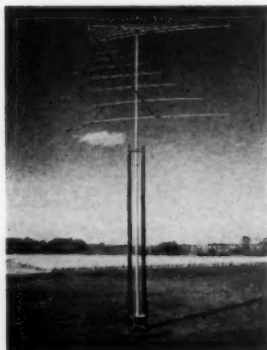
COLLINS LOG PERIODIC ANTENNAS

A radically new approach to broadband antenna design based on the principle of Logarithmic Periodicity has resulted in antennas with radiation patterns and impedance characteristics essentially independent of frequency. One Logarithmically Periodic Antenna can perform the functions previously requiring a large number of antennas, covering bandwidths as high as 10-to-1, with 100-to-1 within the realm of practicality.

The Logarithmic Periodic concept is based on a structural geometry in which the electrical characteristics repeat periodically as the log of the frequency. Since only minor changes occur over each period, and therefore all periods, the characteristics are essentially constant over the whole frequency range.

Typical is the rotatable Collins 237A (above), available for 6-58 mc. The elements form trapezoidal teeth in two planes of equilateral triangles. Radiation is unidirectional with horizontal polarization, providing a free space gain of 8 db over an isotropic antenna. The VSWR is less than 2.25:1, and the peak power capacity is 50 kw.

The principle may be used in omnidirectional antennas and in fixed antennas in which the vertical plane pattern is also frequency independent. Some other applications include electronic countermeasures and use as primary feeds for reflector and lens type antennas. Your Collins representative can provide details on these and other applications of this advanced antenna.



237A ANTENNA (left) with unidirectional beam may be rotated to any azimuth for general communication.

237E is a horizontally polarized log periodic antenna for point-to-point applications between 1320 km and 1850 km.





for the
most
reliable
relay
socket
performance...

PLUG-IN HYFEN[®] SOCKET

WITH CRIMP-TYPE, SNAP-LOCKED TERMINATIONS

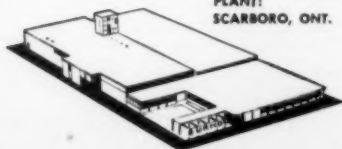


a new line of Hyfen connectors for plug-in relays, including crystal can relays . . . crimp-type Hyfen terminations provide thousands of identical installations for stable electrical and mechanical performance under extreme conditions of vibration, shock, and acceleration. Sockets available to mate with relays of all leading manufacturers. For further information write



Quickly installed individual crimp type terminations are easily removable and replaceable for flexibility of circuitry.

PLANT:
SCARBORO, ONT.

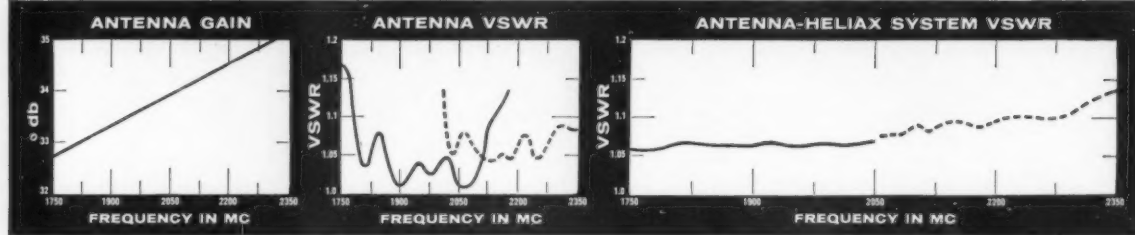


TORONTO, ONT.

HALIFAX • MONTREAL • TORONTO • WINNIPEG • REGINA • CALGARY • VANCOUVER

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NO MARGIN FOR ERROR...



Antenna performance based on 60% gain factor

High and low band antenna VSWR plots of production test samples

Test results of high and low band production antennas and 110 feet of 7/8 inch HELIAx cable

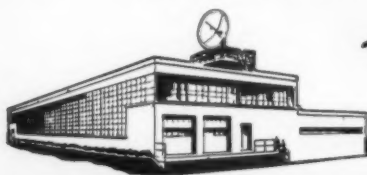
A 600-channel microwave system to carry vital defence data was recently developed by Canadian-Marconi Company for the Royal Canadian Air Force. Because of its strategic value, this long haul line-of-sight system demanded reliable performance in the antenna equipment.

ANDREW Antenna Corporation, Ltd. is proud to have been chosen to design and produce this equipment to meet specific system requirements.

ANDREW microwave antenna, Type 21362, designed for this 1790-2260 mc system guaranteed a vswr under 1.1. Minimum antenna gain of 33 db resulted from production models having gain factors of better than 60%. The antenna characteristics were sustained in the system through the use of ANDREW HELIAx, the flexible air dielectric cable. HELIAx was chosen for its low vswr and attenuation, ease of handling and mechanical stability.

Automatic pressurizing equipment to regulate the dry air supply for this RF system was provided with an ANDREW Type 1910 dehydrator.

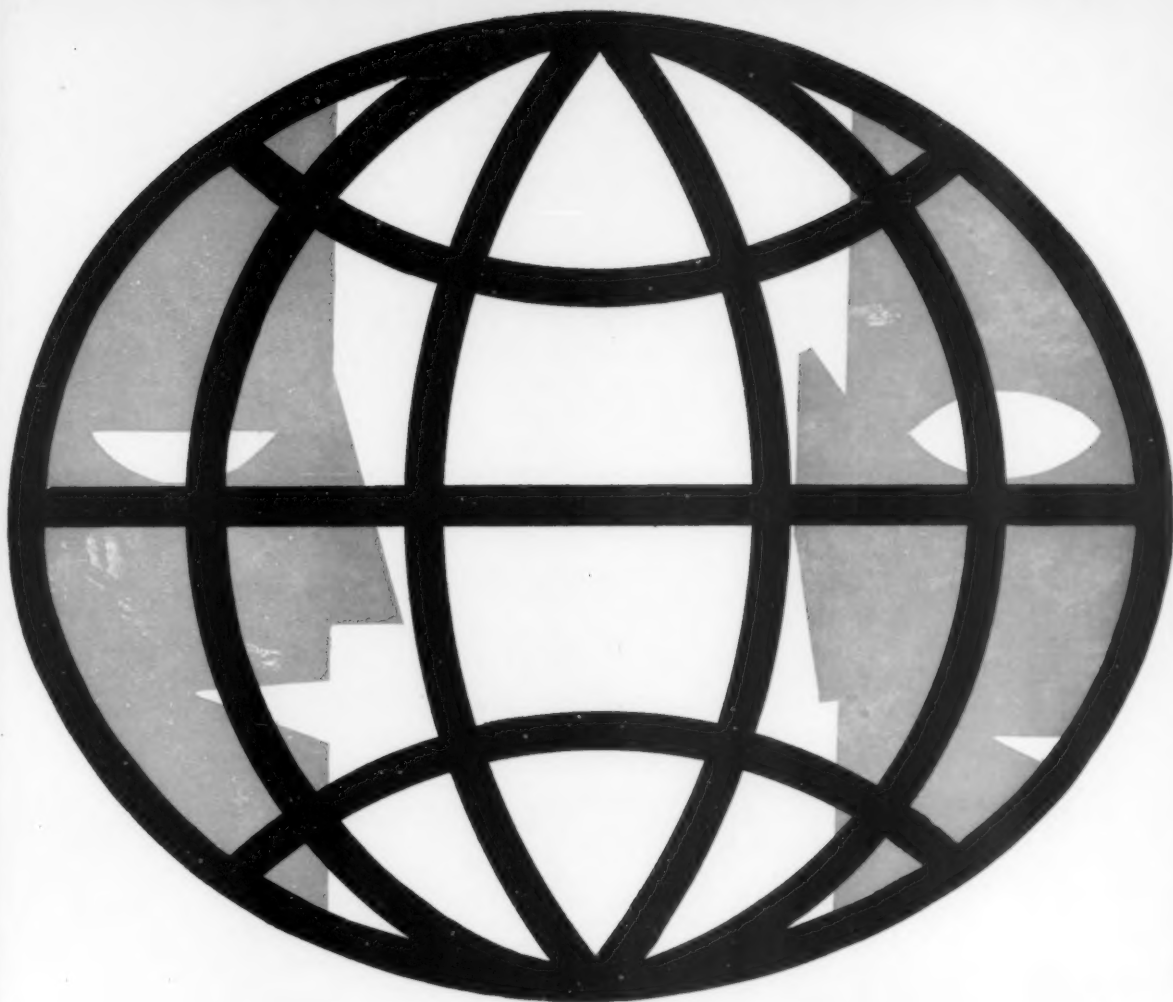
This is just one of many ANDREW antenna system installations in Canada that are consistently giving optimum performance in UHF/VHF and microwave frequencies. To get all the facts on ANDREW antenna systems, write or call today, giving your specific requirements.



Andrew
ANTENNA
CORPORATION LTD.
606 Beech St. • Whitby, Ontario, Canada
Telephone: MOhawk 8-3348

ANTENNAS • ANTENNA SYSTEMS • TRANSMISSION LINES

For further information mark No. 14 on Readers' Service Card



THE AGE OF TOTAL COMMUNICATIONS!

It's barely a half-Century since the human voice was transmitted over distance for the first time. Eleven years later — 1919 — the first Canadian radio station commenced regular transmissions to a few enthusiasts operating home-made crystal sets.

From this one-station start grew a communications giant which now boasts more than two hundred radio stations and a potential audience which encompasses the total population of Canada!

Then to, the growth of television has been even more spectacular!

By the latest count fifty-six stations now transmit daily to an audience in excess of fourteen million Canadians!

As that first recorded transmission between Rome and Sicily in 1908 paved the way to total communications in Canada, so has Standard Telephones and Cables contributed equally . . .

STC have designed, manufactured and installed communications links . . . radio, television, telephone and telegraph . . . in fifty-seven countries — including more than a thousand miles of television-telephone microwave links in Canada!

AMONG THE FOREMOST IN WORLD COMMUNICATIONS!



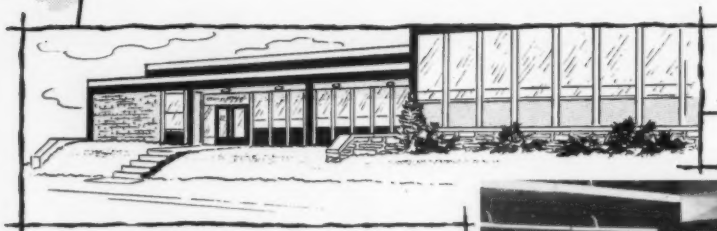
AN ASSOCIATE OF



STANDARD TELEPHONES & CABLES MFG. CO. (CANADA) LTD., MONTREAL.

For further information mark No. 91 on Readers' Service Card

Announcing
GUARDIAN®
 CONTROLS NOW BEING
 MADE IN CANADA BY
CARRIERE AND MacFEETERS
 COMPONENTS MANUFACTURING DIVISION
TORONTO



INSPECTION DEPARTMENT

Joining vast experience in electronic control engineering and development with the know-how and facilities for component production, Guardian Electric and Carriere and MacFeeters Limited have embarked upon a combined design and manufacturing program to serve the growing Canadian electronics market.



ASSEMBLY DEPARTMENT

**CARRIERE AND MacFEETERS LIMITED AND
 GUARDIAN PRODUCTS INCLUDE:**

- Aircraft, missile and military controls—relays, solenoids, steppers, switches, contactors, aircraft gun grip assemblies and special mechanical devices—
- The complete Guardian line of controls for industry. Many of these are standard stock items and are available nationally from leading electronic parts distributors.

Guardian Electric as well as Carriere and MacFeeters Limited products are sold throughout Canada by A. C. SIMMONDS & SONS, Ltd., 100 Merton St., Toronto 7, Phone Hudson 5-9111

GUARDIAN  ELECTRIC
 MANUFACTURING COMPANY

1550 W. CARROLL AVENUE, CHICAGO 7, ILLINOIS

For further information mark No. 49 on Readers' Service Card

United Eyelets

*Lowest Cost
Fastener
You can buy*

Low initial cost per thousand, low installed cost with highly engineered high speed United Eyeletting machines, and you have an unbeatable combination you can put to work saving money. They will join dissimilar materials, can be clinched tightly to fasten, or lightly to function as a pivot.

They can be used as a bearing, or as a terminal. With ceramics, plastics, and glass special machine device helps minimize fracturing. You can get them from stock in a wide range of sizes, colors, and metals. A host of special diameters, lengths, shapes can also be made to solve your individual problem.

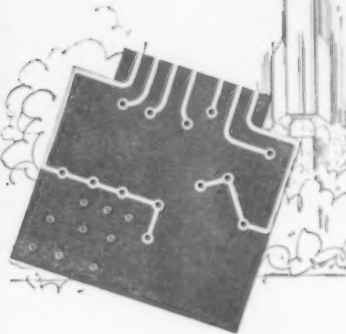
See our catalog in Sweets' Design File or write us today to investigate the possibilities of utilizing lowest cost United Eyelets for your product.



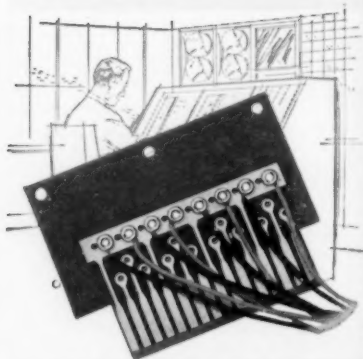
High speed fastening of 2 eyelets simultaneously cuts costs on automotive ignition breaker point assembly.



Eyelet does double duty as fastener for wind shield, bearing for spark wheel. Does both jobs well for only a fraction of a cent.



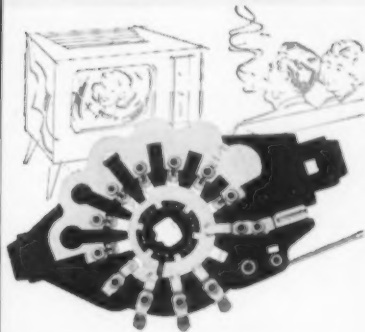
For high altitude or on the ground, funnel flange eyelets provide positive means for making reliable thru-connections on two-sided printed wiring boards.



JUST plug it in — United Standardized eyelets hold wires by compression on multi-contact computer part. Tight hold eliminates soldering time and bulk.



Before you say "hello", eyelets are working for you on our most popular method of communication. Try them on a new application — perhaps they'll prove as indispensable as your telephone.



You can avoid the inevitable commercial with the T.V. Selector Switch and still enjoy the silent utility and performance of eyelets on the switch itself.

Free Eyelet Slide Selector helps determine which eyelet you need with given grip and hole diameter.

United

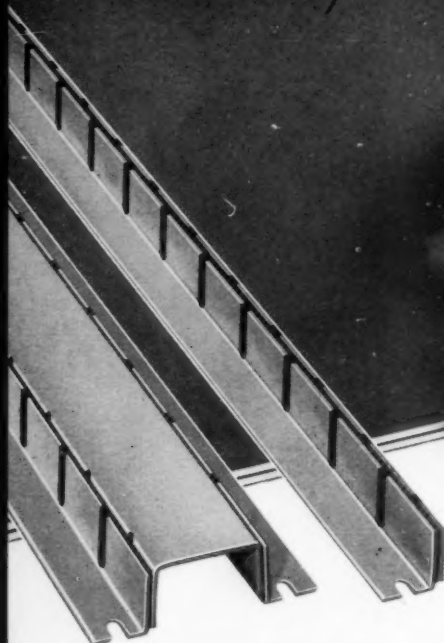
INDUSTRIAL SALES DIVISION
UNITED SHOE MACHINERY COMPANY
OF CANADA LIMITED

MONTREAL • TORONTO • GALT AND QUEBEC

For further information mark No. 102 on Readers' Service Card

A NEW
ENGINEERING
MATERIAL

LORD DYNA-DAMP



Dyna-damp panels and structural sections* can be designed in many configurations for addition to existing structures or fabrication as complete damped assemblies.

*built-in damping
dissipates random vibration
and high-energy noise . . .
controls structural response*

Lord announces Dyna-damp—a new engineering material that counteracts broad-band “white” noise and vibration. It offers a new, better way to solve acoustic fatigue and structural response problems.

Dyna-damp’s laminated design converts vibratory energy into shear strains which are dissipated in a highly damped viscoelastic layer. The damping medium is a special form of BTR® elastomer, bonded between metal elements to give structural integrity and load-carrying strength.

In jets, missiles, ships, vehicles, electronic units—wherever control of resonant response is required—Dyna-damp can introduce dramatically improved performance, higher reliability. It is available to industry in sheet and structural sections or in engineered, finished products for use as primary or secondary structures, electronic chassis, complete mounting systems.

Design engineers can obtain further information and able application assistance on Dyna-damp from the nearest sales office of Railway & Power Engineering Corporation Limited.

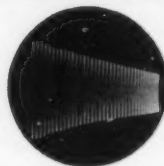


RAILWAY & POWER
Engineering Corporation Limited

New Glasgow • Quebec • Montreal • Noranda • North Bay • Ottawa • Toronto • Hamilton • Windsor • Sault Ste. Marie • Winnipeg • Calgary • Edmonton • Vancouver

For further information mark No. 82 on Readers' Service Card

**Radically
Improved
damping is
illustrated by
typical decay
rate traces.**



Undamped: 2024 T-3
aluminum panel



Damped: 3-ply
Dyna-damp panel

DYNA-DAMP FEATURES

High strength: bonded construction provides structural integrity across complete part. Ultimate strength: 60% of solid aluminum. Shear strength of BTR layer: over 500 psi. Climbing drum peel strength: over 60 lbs.

Light weight: lighter than aluminum sheet of equal thickness.

Excellent fatigue life: proved greatly superior to aluminum in acoustic tests to 170 db.

Broad temperature operation: -65° to +250°F.

Ease of fabrication: can be punched, sheared or stretch formed by standard methods . . . fastened by riveting or adhesive bonding . . . sections can also be spot welded.

Environmental resistance: good strength and damping ability maintained after 7-day immersion in aircraft fluids.





... and 200 miles away a telephone rings!

Eight hours ago, an expanse of barren mountainous country made communication impossible. Tonight, 60 telephone channels and teletype span the wilderness.

Transportable MICROSCATTER is a super high frequency radio system for long-range communication. Developed by Canadian Westinghouse, MICROSCATTER beams signals high above the earth sending two-way voice and teletype messages up to 200 miles over land and water . . . *without* costly relay stations.

The compact MICROSCATTER radio system fits in a standard 30 ft. truck trailer. Now, whenever men and equipment move, MICROSCATTER moves right along with them. It is particularly suited to military and government projects in remote locations. Units designed for self-contained field operations are set down by helicopter.

CANADIAN

Westinghouse Microscatter

For further information mark No. 34 on Readers' Service Card

60-A-745

A Westinghouse communications specialist will be pleased to explain fully the MICROSCATTER operation and relate it to your problem. Contact your nearest Westinghouse office, or write to Canadian Westinghouse Company Limited, Electronics Division, Hamilton, Canada. **YOU CAN BE SURE . . . IF IT'S WESTINGHOUSE.**

MICROSCATTER APPLICATIONS

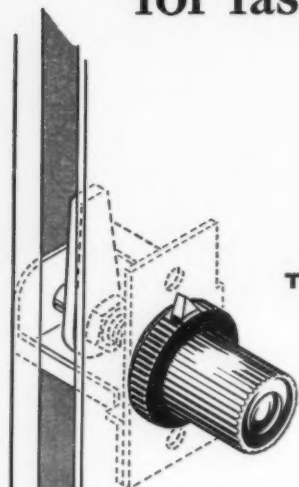
| COMMERCIAL | MILITARY |
|---|--|
| Fixed Station—120 telephone channels —television and sound | Wide Band —radar —data —120 telephone channels |
| Transportable—60 telephone channels —teletype | Tactical and —60 voice channels Transportable—teletype —data |

FEATURES

- Frequency—4400-5000 mc
- Power—2 KW
- Antennas—10 to 28 ft. diameter
- Range—100 to 200 miles

Standards with unique features for fastening doors and panels

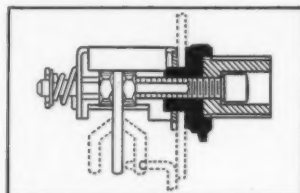
Southco adjustable pawl fasteners are easy and economical to install, give a "class" appearance to equipment. They apply controlled pressure to seal tightly and stop rattles.



TWIN KNOB CONTROL—NO. 46

The pawl engages the frame when the actuator is turned 90°. A bright chrome button in the center of the knob is preset for the amount of pressure to be exerted by the fastener. After the pawl engages the frame, the knob is turned until the button is flush with the knob surface. Preset pressure is thus obtained.

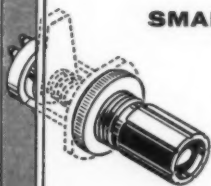
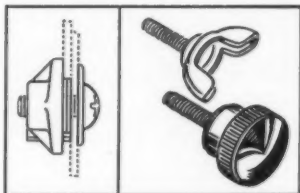
Materials *Body: Cadmium plated steel*
Knob: Black nylon



MINIATURE ENVELOPE—NO. 45

Requiring a minimum of space inside and outside, this fastener latches on a 1/4 turn and additional turning pulls up the door or panel against its frame. The nylon pawl operates smoothly against metal and provides exceptional wearing qualities.

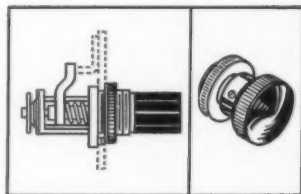
Materials *Pawl stop and washers: Carbon steel, cadmium plated*
Pawl: Nylon, natural



SMALL, HEAVY-DUTY MOUNTING—NO. 48

Small, rugged, compact. One quarter turn closes, additional turning tightens. Quickly installed with a single mounting nut. Three sizes cover every frame thickness from .000 to .750. Can be supplied with flatted shaft for your knob.

Materials *Body and pawl: Steel, cadmium plated*
Knob: Black nylon



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LION

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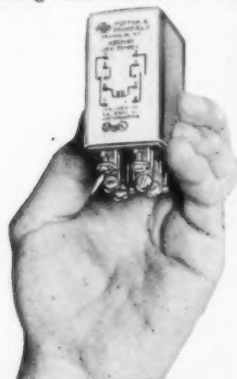
CANADIAN ELECTRONICS ENGINEERING OCTOBER 1960



appearances are not deceiving

THIS P&B 10-AMP RELAY IS AS RELIABLE AS IT LOOKS

Our AB relay looks rugged . . . and it is. You can specify it for 10 amp switching and confidently expect 100,000 cycles. Yet it is compact, easily mounted, and does not require special handling. Installation is simple, using your preference of screw terminals (adapters), quick connects, or dip soldering.



ABC Series—AB series can be supplied enclosed in sturdy metal dust cover, $1\frac{1}{4}$ " x $2\frac{1}{2}$ " x $2\frac{1}{2}$ ".

Designers specify the AB for air conditioners and other products where dependable, continual service is paramount.

These standard AB and ABC relays are listed by Underwriters' Laboratories and Canadian Standards Association:

| Type | Arrangements | Type | Arrangements |
|--------|--------------|---------|--------------|
| AB7AY | DPST-NO | ABC7AY | DPST-NO |
| AB8AY | DPST-NC | ABC8AY | DPST-NC |
| AB11AY | DPDT | ABC11AY | DPDT |

Coil voltages: 6, 12, 24, 115 and 230 volts AC, 50/60 cycle.
Contact rating: 10 amps, 115 volts AC or 5 amps,
230 volts AC noninductive.

U/L File E-29244

CSA No. 15734

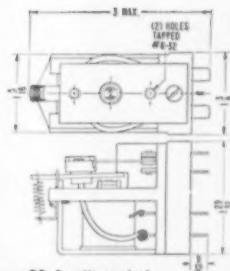
Write for complete data or contact your nearest P&B sales engineer.

AB AND ABC RELAYS ENGINEERING DATA

GENERAL:
Insulation Resistance: 100 megohms minimum.
Life: 3 million cycles (mechanical).
Breakdown Voltage: 1500 volts rms between all elements and ground.
Temperature Range: DC: -55 to +45°C.
AC: -55 to +45°C.
Weight: AB—5 ozs. ABC—7 ozs.
Terminals: Fit $\frac{1}{4}$ " quick-connect terminals, or may be applied to printed circuits using dip soldering. Screw adapters furnished on request.
Enclosure: ABC: Heavy duty dust cover.
Dimensions: $1\frac{1}{4}$ " x $2\frac{1}{2}$ " x $2\frac{1}{2}$ ".

CONTACTS:
Arrangements: DPDT
Material: $\frac{1}{4}$ " dia. silver. Other materials available.
Load: 5 amps at 230 volts AC or 10 amps at 115 volts AC noninductive.
10 amps at 28 volts DC.

COIL:
Voltage: DC: 6 to 110 volts.
AC: 6 to 230 volts.



Power: DC: 2 watts nominal.
AC: 6.4 volt-amps.
Resistance: 35,000 ohms max.
Duty: Continuous: DC coils will withstand 6 watts at +25°C.

MOUNTINGS:
AB: Two 8-32 tapped holes on $1\frac{1}{4}$ " centers.
ABC: One 8-32 stud $\frac{1}{4}$ " long and locating tab.

**P & B STANDARD RELAYS
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There's a **BEATTIE OSCILLOTRON*** for every oscilloscope recording need



K-5 Dichroic mirror permits simultaneous recording and parallax-free viewing. Available with Polaroid® Land back for 60 sec. prints. Records up to 10 traces on a single frame. Or can be equipped with either 35mm electrically-pulsed or continuous-motion magazine. f/1.9 standard or flat-field lens.



DIRECT VIEW Provides a direct, binocular view of the CRT while recording. Non-reversed image. Uses Polaroid® Land back. Records up to 10 exposures on 1 frame. Electric shutter actuator optional. Also available in electrically-pulsed or continuous-motion 35mm or 70mm models. Camera swings back, lifts off. f/1.9 standard or flat-field lens.



KD-5 Best for special lab situations requiring simultaneous recording of CRT phenomena and identifying data. Written information, counter and 24 hour clock can all be recorded on same frame. Electric camera with Automatic 35mm pulse or continuous-motion magazine. Dichroic mirror for simultaneous viewing. No parallax.

* Trade Mark

When it comes to recording oscilloscope traces, there's only one thing to remember, Beattie Oscillotron. Each of the three models shown here is designed for a special purpose. Each embodies the advanced engineering and precision craftsmanship that have made Beattie the leader in the industry. Which Oscillotron is best for you? Tell us your needs and we'll help you decide. Write or phone today for full information.



ALEX L. CLARK LTD.

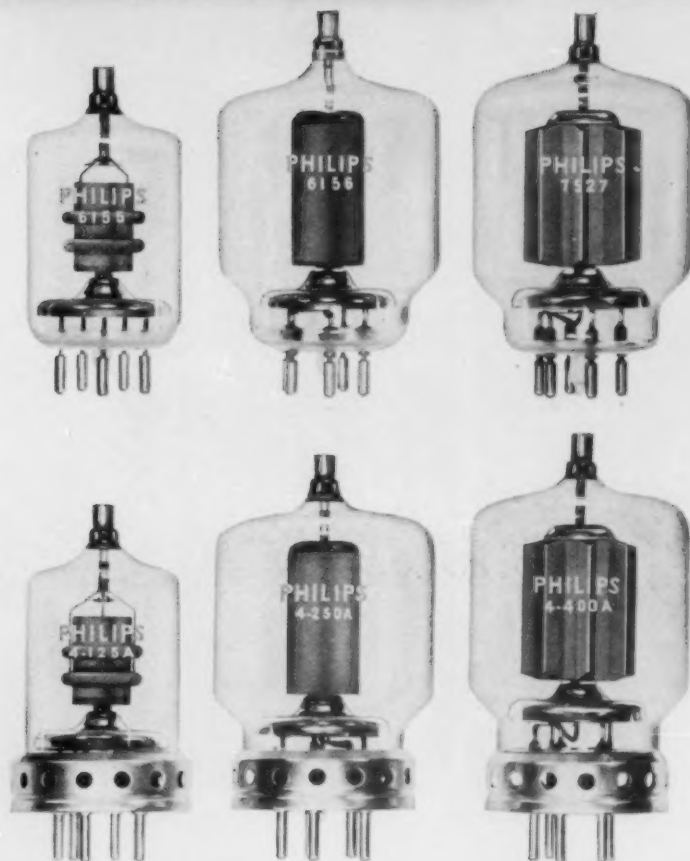
**3751 BLOOR ST. W., TORONTO
BE. 1-3303**

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ROGERS

REFERENCE
BULLETIN NO. 7

Clip and file this reference sheet for future use



Philips tetrodes in six designs for original equipment or improved plug-in replacements

Here are 6 Philips tetrodes from Rogers that combine optimum performance and maximum reliability with an unrivalled latitude of selection. Available with powdered glass or standard metal base, these tubes feature massive zirconium treated graphite anodes to handle large, temporary overloads. The ruggedized sintered glass bases provide lower lead inductance, excellent heat dissipation characteristics and dimensional compactness. The standard metal bases insure a complete range of replacement types from which to choose.

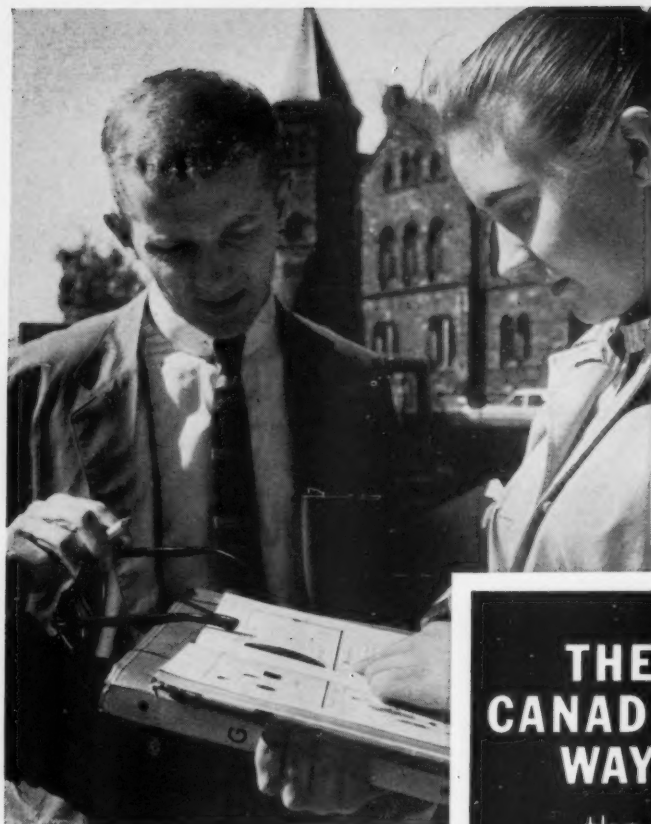
| Powdered Glass Base Types | Metal Base Types | Max. Diss. Watts |
|------------------------------|---------------------|---------------------|
| 6155 | 4-125A | 125 |
| 6156 | 4-250A | 250 |
| 7527 | 4-400A | 400 |

ROGERS

electronic tubes & components

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Canadians



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to a richer sense
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There's a Canadian way of doing things — of living, working and learning. It's a good way of doing things by any standard. For Canadians it's the best way.

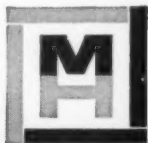
Our schools and universities offer one example of this. They fill a very special need: educating our young people for service to their communities; preparing them — as no other education can — for the challenge of our country's future.

As Canada's leading national publishing house, Maclean-Hunter, too, meets this vital need. The

editors of its national magazines, business and financial publications have a common purpose: to inform, to entertain, to foster a better understanding of our country, to interpret world events in terms of their significance to Canadians.

Thus Maclean-Hunter publications contribute to the development of a Canadian spirit and a richer sense of citizenship. Together they preserve and strengthen the priceless vehicle of Canadian expression. They are, in fact, part of the Canadian way . . . the best way for Canadians.

MACLEAN-HUNTER



PUBLISHING CO. LTD.

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ACTUAL SIZE



This is the actual size of Heinemann's new sub-miniature circuit breaker, the SM3. Hermetic seal and all, it weighs no more than a bantam 2.1 ounces. It is magnetically actuated, therefore does not require de-rating for high ambient temperatures. In fact, under extensive environment-testing, the breaker has demonstrated excellent all-around operational stability. It will function properly on the tundra or in the tropics, will withstand the onslaughts of salt-sea atmosphere, sand, dust and high humidity. The SM3 is available to

your specifications in any integral or fractional current rating from 0.050 to 10 amperes, at 110V, either 60 or 400 cycles AC, or 50V DC. And you have a choice of either fast or slow time delay, so that overload response can be matched closely to the operating characteristics of the protected equipment. If you have need of a rugged, compact circuit breaker "packaged" to go anywhere, you'd do well to give the SM3 some serious consideration. The facts and figures are presented for your review in Bulletin 3502. Write for a copy today.

HEINEMANN ELECTRIC COMPANY, 166 PLUM ST., TRENTON 2, N.J.

±1% AC Voltage Regulation

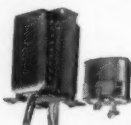


Sola Constant Voltage Transformers

These static-magnetic units automatically and continuously regulate line voltage within $\pm 1\%$ under input voltage fluctuations of as much as $\pm 15\%$ for all types of electrical and electronic equipment.

There are no manual adjustments, no moving or renewable parts, no routine maintenance. Sola voltage regulators are compact, simple, trouble-free. They are available in step-up and step-down ratios and with variable voltage outputs.

Type CVS regulators (illustrated above) have less than 3% total rms harmonic content in their output wave, making them ideal for use with rectifiers and other harmonics-sensitive components.

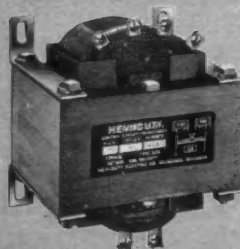


Type CVN units (illustrated here in end bell construction with separate capacitor) have about 14% total rms harmonic content. They provide a reliable voltage source for filaments, relays, solenoids, a-c transformers, and similar loads. This series includes designs suitable for use as components.

Sola regulators are available in 67 stock models in capacities from 15 va to 10,000 va. Custom designs can be delivered in production quantities.

Write for Bulletin CV

Only 5% drop at 1000% inrush



Hevi-Duty Industrial Control Transformers

These dependable dry-type control-circuit transformers are designed, constructed, and tested to give you exceptionally long service even under severe operating conditions. Type SZO (illustrated above) features layer-wound coils and new, improved proportions, which reduce voltage drop caused by peak inrush currents. In fact, at 1000% inrush current, the drop below rated voltage is only 5%.

This extra capacity enables you to specify transformer size according to your sealed volt-amperes, and thus save on both initial cost and panel space since in most cases you will be able to use a smaller unit.

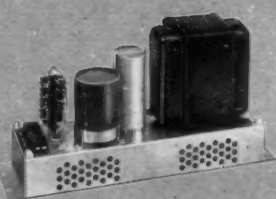
A high insulation level is provided by folded insulating papers between layers, varnished cambric between windings, a pre-formed coil base, and heavy insulating channels between core and coil.

In addition, Hevi-Duty Transformers feature firmly anchored screw-type terminals, slotted mounting feet for easy installation, and a wiring diagram on the nameplate to eliminate installation errors.

Each transformer is given tests for turns ratio, polarity, and high-voltage breakdown. Units meet or exceed NEMA and ASA standards. They are available in 50 or 60 cycles, 50 va to 5,000 va.

Write for Bulletin DWC

±1% DC Voltage Regulation



Sola Regulated DC Power Supplies

These compact, light-weight d-c power supplies handle intermittent and pulse loads in the "ampere" range. They exhibit 1% (or less) ripple voltage, output regulation of $\pm 1\%$ or less under $\pm 10\%$ line voltage variations, self protection against high short-time overloads, and extremely low output impedance.

These small, economical fixed d-c supplies require no maintenance. They are widely used as components in equipment with relays, solenoids, or high amperage requirements.



This is the Solavolt adjustable d-c power supply. It provides a regulated source of variable d-c voltages for testing, research and design development.

The D-C Solavolt gives you all of the basic characteristics and advantages of the fixed design first described, plus selection of desired voltage by turning a dial. It can be relay-rack mounted on a standard 19" frame, or is portable and self-stacking if desired.

The unit is 7" high by 12 1/4" deep and, like the fixed design, is available in six stock models.

Write for Bulletin DC

SOLA



SOLA-BASIC PRODUCTS LTD.

377 Evans Ave., Toronto 18, Clifford 1-1147

Consult your Sola/Hevi-Duty representative for complete information on these products.

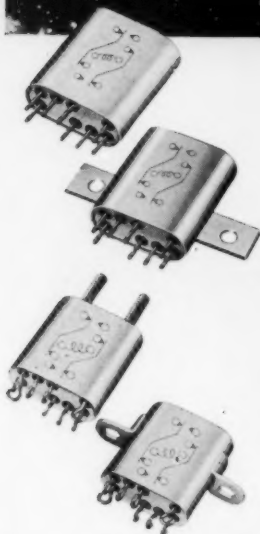
An Affiliate of Basic Products Corporation

In U.S.A., Sola Electric Co., Busse Rd. at Lunt, Elk Grove, Illinois

For further information mark No. 89 on Readers' Service Card

crystal can size relays

by **ADVANCE**



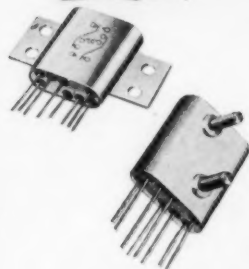
—these construction
features assure
exceptional reliability:

Positive sealing. Advance's use of induction heating cuts rejects from faulty soldering to a negligible figure. Soldering is accomplished at high speed, hence damage to the relay due to heat transfer is eliminated.

RADIFLO testing for leakage is used to detect leaks as small as 10^{-8} cc/sec. All relays that pass this test will function after long shelf life.

RIQAP program approval. Under RIQAP, the Signal Corps constantly checks Advance's quality control and inspection, to insure military standards of reliability for all Advance customers, both military and industrial.

NOW CRYSTAL CAN RELAY MV 1033
meets the requirements of
MS24250-6 (USAF)



SPECIFICATIONS

| | |
|-------------------------|---|
| Coil resistance: | Available in 7 values, from 30 to 10,000 ohms. |
| Shock: | 50 G's for 11 milliseconds. |
| Vibration: | 10 to 34 cycles per second at maximum excursions of .4". 34 to 2000 cps 20 G's acceleration. |
| Operating power: | Pull in power 250 milliwatts at 25°C. |
| Contact rating: | 2 amps resistive at 32 VDC or 115 VAC. |
| Life: | 100,000 operations minimum at rated current. |
| Weight: | 0.45 ounce. |
| Size: | $\frac{7}{8}$ " high x $\frac{51}{64}$ " wide x $\frac{23}{64}$ " deep. |

Write today for catalogue information on the complete line of Advance Relays stocked and sold in Canada exclusively by

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Last year, Canadian businessmen invested nearly \$30,000,000 of their companies' money in business publication advertising to promote their products or services.

That's a significant fact to all businessmen. And there is one more. 61% of that money was invested in the more than 140 publications that are members of B.N.A. (Business Newspapers Association of Canada.)

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6-3

THE *BEST* CANADIAN BUSINESS
PUBLICATIONS BEAR THIS EMBLEM



BUSINESS NEWSPAPERS

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AUTOMATION IN DATA TRANSMISSION!



*New Telesignal Dispatcher Model TD1
Does Not Require Skilled Operator—
Improves Accuracy, Convenience, Speed.*

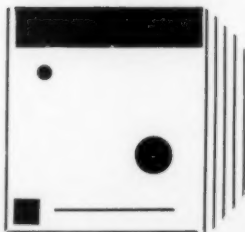
Now, through the science of Philco-Canada, automation comes to the field of data transmission. Weather forecast systems, air and rail lines, banks, refineries—almost every major industry or business will find important savings in speed, accuracy and personnel by applying this new Philco invention to data transmission problems.

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CANADIAN ELECTRONICS ENGINEERING OCTOBER 1960



IRE Symposium on Communications

Sponsored by the Montreal Section of
The Institute of Radio Engineers, Inc.

Montreal, November 4-5, 1960

GENERAL INFORMATION

The Montreal Section of The Institute of Radio Engineers, Inc., will be host to engineers, executives, educators, technicians and buyers from Canada and the United States when they present their 1960 Symposium on Communications, November 4-5.

The two-day program combines a forum of the latest engineering achievements in communications, along with a display of the industry's newest products.

All technical sessions and exhibits will be located in the Queen Elizabeth Hotel, right in the heart of Montreal.

REGISTRATION

IRE members and all those interested in communications are welcome to attend the symposium. Registration fee at the door is \$2.00 for members of IRE (all grades including students) and \$3.00 for non-members. If the advance registration card on page 105 is mailed before October 20, registration fees will be \$1.00 and \$2.00 respectively. This covers all technical sessions and exhibits. Social functions are extra as outlined below.

TECHNICAL PROGRAM

Twenty-four technical papers will be presented by competent engineers and scientists from Canada and the United States in six separate sessions. Both practical and theoretical, the papers have been carefully selected by the committee from a field of 58 papers originally submitted for consideration.

In addition to the papers, there will be a panel discussion Friday evening, Nov. 4. The panelists and subject have not yet been announced. Full details of the technical sessions start on page 53.

Technical sessions

Nov. 4: 2.30 pm to 5.00 pm
7.00 pm to 9.00 pm
Nov. 5: 9.30 am to noon
2.30 pm to 5.00 pm

Exhibits

Nov. 4: 9.00 am to 10.00 pm
Nov. 5: 9.00 am to 6.00 pm

Social events

Opening luncheon, Nov. 4, Du-luth room, 12.30 pm
Cocktail get-together, Nov. 4, 9.00 pm
Cocktail hour, Nov. 5, 6.00 pm
Buffet dinner, Nov. 5, 7.00 pm

reserved by using the registration card on page 105.

LADIES' ACTIVITIES

Ladies are, of course, invited to join their escorts for the social events. Interesting activities for them while the men are in technical sessions are being arranged.

HOTEL ACCOMMODATION

For your convenience, special rates at the Queen Elizabeth Hotel for a limited number of those attending the Symposium have been arranged: \$10 for single room, \$14 for twin room. Reservations are to be made directly with the hotel using the card on page 105. It must be mailed before October 15.

Reservations elsewhere should be made directly with the hotel of your choice.

TRANSPORTATION

Commercial rates are available for travel by the Canadian National Railways, Canadian Pacific Railway or Trans-Canada Air Lines. To obtain a certificate for such rates, check the pertinent box on the registration card on page 105.

EXECUTIVE COMMITTEE

E. P. Turton, General Chairman
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A. F. Wells, Local Arrangements
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Mrs. R. J. Wallace, Ladies' Arrangements

EXHIBITS

Thirty-nine exhibitors will display their latest products, with emphasis on components and equipment relating to communications. See page 72 for more information.

BUSINESS ADDRESS

IRE Symposium, P.O. Box 802,
Station "B", Montreal, Quebec.

SOCIAL EVENTS

Formal opening of the Symposium will take place at a luncheon commencing at 12.30 p.m., Friday, Nov. 4. Guest speaker will be Dr. R. L. McFarlan, president of the Institute of Radio Engineers for 1960.

Following the panel discussion Friday evening there will be a "Cocktail get-together" commencing at 9.00 p.m. Social events for Saturday, Nov. 5, are a Cocktail hour and Buffet dinner at 6.00 p.m. and 7.00 p.m. respectively.

Tickets for all social events may be purchased at the registration desk, or

Communications are vital to progress of IRE



Ronald L. McFarlan
*Consultant, Chestnut Hill,
Massachusetts*

*President, The Institute
of Radio Engineers, Inc.*

It is most fitting that the Montreal Section of The Institute of Radio Engineers has chosen the field of communications for its symposium next month. It is a subject of wide general interest throughout our Institute and one of special interest to you in Canada because of your geography.

Your vast area, relatively small population and proximity to regions of frequent auroral disturbances, have created simultaneously a great need for effective communications and many technical problems. The record of your engineers should be a matter of great pride to you. And I am pleased to note, after looking over the preliminary list of papers for the symposium, that the high standard of technical work is being maintained.

Taken in the broader sense, communications are important to everyone in IRE. In fact, communicating ideas and technical information is the very life-blood of our Institute. IRE was established in 1912 for the . . . "advancement of the theory and practice of radio and electronics, including allied branches of engineering and the related arts and sciences." It has attained its present stature, with an international membership in excess of 72,000, primarily through its adherence to an active policy of disseminating technical information.

The growth of electronics, as an industry and a technology, since the early days of World War II has been remarkable to say the least. It could not have been achieved without the effective exchange of information among scientists, engineers and technicians working in this field. We take pride in the fact that IRE has played a leading role.

The growth of IRE, in numbers, scope of activity and international character, has presented many problems in communicating with members. It has lead to an organization with a strong central core to unify and guide the Institute in the best interest of all members. But to cope with the problems of distance and special interests, the Institute makes effective use of Professional Groups, Regions and Sections. Each has an important role to play in advancing the aims of IRE.

Similarly, we employ two main media for the exchange of technical information — publications and meetings. And each has its part to play. I was pleased when I first heard that the Montreal Section intended to hold a communications symposium. I hope that many of the papers presented there will eventually be published so that all members of IRE will be able to derive benefit from them.

Since taking office earlier this year I have had the pleasure of visiting many IRE Sections, including some in Canada. I look forward to my trip to Montreal November 4, and the opportunity of meeting more of my fellow members.

Twenty-four papers to be presented

Here is a schedule of the twenty-four papers selected for presentation at the 1960 Canadian Symposium on Communications. Note the panel discussion scheduled for Friday evening, November 4; topic and panel members will be announced at the symposium.

Summaries of all technical papers, along with information about the authors, appear in the following pages. They are in sequence of paper number. By studying the summaries you will be able to derive greater benefit from the papers when they are presented.

Friday, November 4

2.30 p.m. to 5.00 p.m.

GATINEAU ROOM

2.30 p.m.

1. *The MM-600 microwave system between Rimouski and Mt. Carlton*
L. A. Martin, J. E. H. Elvidge, N. M. Lopianowski
RCA VICTOR COMPANY, LTD.

3.10 p.m.

3. *A new 450-Mc radio relay system*
G. H. Colberg
NORTHERN ELECTRIC CO. LTD.

3.50 p.m.

5. *A two-hop 450-Mc diffraction-plus-scatter system for telephone service*
J. C. Gillespie
MANITOBA TELEPHONE SYSTEM

4.30 p.m.

7. *An improved design of radio relay equipment in the 132- to 174-Mc range*
A. A. Seljak
PHILIPS ELECTRONICS INDUSTRIES LTD.

ST. MAURICE ROOM

2.30 p.m.

2. *Miniaturized solid state devices for communications systems*
John Clark
SPERRY MICROWAVE ELECTRONICS CO.

3.10 p.m.

4. *A transistorized frequency synthesizer*
G. Husson, B. N. Sherman
CANADIAN MARCONI COMPANY

3.50 p.m.

6. *A new electronic tube — the LECTRON*
J. C. Bernier
ECOLE POLYTECHNIQUE

4.30 p.m.

8. *The transistorized thyatron ring counter*
Joseph A. Pecar
UNIVERSITY OF DETROIT

7.00 p.m. to 9.00 p.m.

ST. LAURENT ROOM

Panel Discussion

Saturday, November 5

9.30 a.m. to 12.00 noon

ST. LAURENT ROOM

9.30 a.m.

9. *Control of interference between surface microwave and satellite communication systems*
W. L. Firestone, S. G. Lutz, Jack Smith
MOTOROLA INC., HUGHES AIRCRAFT CO., GENERAL ELECTRIC CO.

10.10 a.m.

11. *Siting of microwave systems in a radar environment*
A. J. Kingan, L. W. Dennison
THE BELL TELEPHONE CO. OF CANADA

10.50 a.m.

13. *Electromagnetic wave propagation over natural obstacles*
M. P. Bachynski
RCA VICTOR RESEARCH LABS.

11.30 a.m.

15. *High frequency oblique sounding*
W. L. Hatton
DEFENCE RESEARCH TELECOMMUNICATIONS ESTABLISHMENT

ST. MAURICE ROOM

9.30 a.m.

10. *New concepts in mobile radio design*
M. A. Robbins
CANADIAN MARCONI COMPANY

10.10 a.m.

12. *A solid state selector for teleprinter circuits*
T. G. Rankin
CANADIAN AVIATION ELECTRONICS LTD.

10.50 a.m.

14. *Threshold extension for a quadruple diversity tropospheric scatter system*
P. S. Christensen, J. P. Wilde
NORTHERN ELECTRIC CO. LTD., THE BELL TELEPHONE CO. OF CANADA

11.30 a.m.

16. *A variable reactance amplifier for a UHF tropospheric scatter receiver*
Stanley S. Kostashuk
NORTHERN ELECTRIC CO. LTD.

Saturday, November 5

2.30 p.m. to 5.00 p.m.

ST. LAURENT ROOM

2.30 p.m.

17. *Lunar and space communications studies*
B. C. Blevins, J. W. S. Day
DEFENCE RESEARCH TELECOMMUNICATIONS ESTABLISHMENT

3.10 p.m.

19. *Evaluation of the communications systems on the CL-28 Argus aircraft*
S. J. Kubina
CANADAIR LIMITED

3.50 p.m.

21. *Data systems*
P. Pascali
NORTHERN ELECTRIC CO. LTD.

4.30 p.m.

23. *An automatic computer-to-computer communication system for voice-band application*
David N. Lytle, R. L. Ellsworth
BECKMAN INSTRUMENTS INC., LOCKHEED AIRCRAFT CORP.

ST. MAURICE ROOM

2.30 p.m.

18. *CBC television network program delay centre*
G. E. Waters
CANADIAN BROADCASTING CORPORATION

3.10 p.m.

20. *Applications for transmission media*
Joseph H. Vogelmann
CAPEHART CORPORATION

3.50 p.m.

22. *Simultaneous transmission and reception with a common antenna*
W. V. Tilston
SINCLAIR RADIO LABS. LTD.

4.30 p.m.

24. *Phased array communications*
V. E. Trinter
BENDIX CORPORATION

Summaries of technical papers
start on page 54

Summaries of technical papers

Paper No. 1

The MM-600 microwave system between Rimouski and Mt. Carlton

This paper describes the Rimouski-Mt. Carleton microwave television relay system supplied to the Canadian National and Canadian Pacific Railway Companies by RCA Victor Company, Ltd., Montreal, Quebec. This system is the first one installed using the recently developed MM-600 equipment operating in the 2 Gc band.

The paper begins with a general description of the system. The geographical layout, path profiles, and tower heights are dealt with briefly. The frequency plan of 9 rf channels, of which 5 belong to a parallel system owned by New Brunswick Telephones, is described, illustrating the difficulties involved in arriving at the

plan and the method of reversing one of the rf channels carrying television. The specially designed MM-600 antenna and the waveguide runs are discussed and photographs included to typical sites. Expansion capabilities and special switching arrangements for the future are mentioned. Block layouts of the system are shown.

A detailed description of the type MM-600 equipment follows with emphasis on the more interesting and unusual aspects such as the traveling wave tube transmitters and their ventilating system, the quadruplexers, and the transistorized service channel equipment. Some of the more important system and unit levels and gains

are given. Photographs of various details of the equipment are included. The operation of the service channel equipment is explained with the aid of block diagrams.

Because of the high quality of the MM-600 equipment special test equipment has been developed for maintenance purposes. Some of these special units and the testing procedures used are described.

The remainder of the paper presents the results of tests performed on the system. These tests include both video and message performance. Photographs of oscilloscope traces actually obtained on the system serve to illustrate the results of these tests.

Authors

L. A. Martin, **RCA Victor Company, Ltd.**

L. A. Martin graduated with honors in electrical engineering from the University of Toronto in 1955. He then joined Shell Oil Co. and worked at various sites in North America doing electrical distribution design, piping, automatic control design and various other operations. Mr. Martin joined RCA Victor Co. Ltd. in 1958 as an engineer in the Communications Systems Group.

J. E. H. Elvidge, **RCA Victor Company, Ltd.**

Mr. Elvidge is a holder of a Higher National Certificate in Radio Engineering and is a graduate of the Institution of Electrical Engineers (1957). From 1953 until 1959 he was an assistant engineer with the British Post Office. He worked with a group re-



Martin



Elvidge



Lopianowski

sponsible for the provision and maintenance of VHF, UHF and SHF systems for transmission of tv and telephony signals throughout the United Kingdom. In 1960 Mr. Elvidge joined RCA Victor Co. Ltd., Engineering Systems Group, Montreal.

N. M. Lopianowski, **RCA Victor Company, Ltd.**

Mr. Lopianowski received a B.Sc. (Eng.) Honors Degree from the Uni-

versity of London in 1955, then spent five months as a development engineer on VHF signal generators at the British Communications Corp., Wembley. He then moved to Canada and spent a year and a half as a transmission engineer with Northern Electric Co. Ltd., Montreal. In 1957 Mr. Lopianowski joined RCA Victor Co. Ltd., serving first with the Radio Relay Systems Group, then the Communications Systems Group.

Miniaturized solid state devices for communications systems

There have been many recent advances in the development of miniaturized ferrite coaxial isolators and coaxial Y-junction circulators. These advances have resulted in new devices with exceptional features that are now becoming available for the use of the systems engineer. Other devices that offer promise for the near future are miniaturized UHF strip transmission line isolators, solid state limiters, parametric amplifiers, and solid state switches. In this paper primary emphasis will be placed on the recent advances in the development of miniaturized isolators and Y-junction circulators.

From the standpoint of miniaturization of coaxial isolators, the most significant recent advance is an isolator design that eliminates the necessity for a bulky external magnet and, incidentally, solves the problem of magnet shielding. This "internal magnet"

design will be described and the theory of its operation briefly discussed. Complete characteristics including size and weight will be presented in frequency bands of interest for communications purposes. Additional information will be presented on the temperature performance of these devices, including information on differential reflection coefficient under conditions of temperature change. Typical uses of these devices will be presented, along with some discussion of the system problems they solve.

Miniaturized coaxial Y-junction circulators are a more recent development than the "internal magnet" isolators. Sufficient time will be devoted to explaining the nature of their operation to give some insight into their limitations and possible applications. These circulators, in general,

can be made with biasing fields that are either above or below ferrimagnetic resonance. The nature of each of these types of operation will be explained, and their implications for communications applications explored. The characteristics of operative devices in several bands will be presented. In addition to small size and exceptional ruggedness, these devices will be seen to demonstrate superior high power capacity and temperature stability. One circulator, for example, designed for operation in the 5.4 Gc to 5.9 Gc-range, has been observed to maintain excellent electrical characteristics up to power levels of 25 kw peak power and 25 watts average power, and over the entire temperature range from -55 C to 125 C. Exclusive of connectors, but including permanent magnets, the device measures only 1.5 inches in diameter and 0.75 inches in height.

Author

**John Clark,
Sperry Microwave Electronics Co.**

John Clark is a graduate of Georgia Institute of Technology. He was awarded the B.S. in physics in 1958 and the M.S. in physics in 1959. He was the recipient of a United States Atomic Energy Commission Fellow-

ship for study toward his Master's degree. Mr. Clark's preindustrial background includes military experience in radar, and research and development work on electronic circuits for radar applications. Since June, 1959, he has been employed by the Sperry Microwave Electronics Co., actively involved in research and development of microwave solid state components.



Paper No. 3

A new 450-Mc radio relay system

The installation of light route type radio relay systems is often the most economical means of providing telephone or special service facilities to remote areas. Applications of the N450 will include toll service to community dial offices, extended area services, service to remote or mountain areas, supplementation of wire facilities for a higher degree of service reliability, order wire, voice and telemetering services.

The newly developed N450 FM radio relay system, together with OJ telephone carrier equipment, provides a low cost, dependable, toll quality communication system.

Operating in the 450-Mc band its modulation capability extends to 150 kc for up to 24-channel operation, and with reduced deviation ratio to 270 kc for up to 48 channels. With typical single path lengths of approximately 40 miles and a suitable mul-

tiplex loading a total system length of 2,000 miles can be implemented.

An effective alarm, order wire and automatic transfer system has been developed to insure high reliability.

Built-in metering is included to measure the operating functions of the equipment. Test equipment requirements are kept to a minimum.

The choice of antennas and RF transmission lines depends on trans-

(Continued on page 56)

mission calculations and requirements. Cost will have to be balanced against gain or attenuation as well as strength and ease of handling. Suitable antennas are the yagi, corner reflector or parabolic type and a variety of RF feeder cables are available.

An RF branching filter permits the use of a common antenna for transmitting and receiving RF signals.

The N450 radio relay system is suitable for transmission of either double or single sideband transmitted, reduced or suppressed carrier as used in N, ON, OJ or L type carrier systems respectively.

Typical performance calculations confirm that the N450 with OJ carrier meets the most rigid toll transmission objectives.

Simplicity of installation as well as ease of service and maintenance have also been design objectives.

Author

G. H. Colberg, Northern Electric Co. Ltd.

World War 2 was in progress when G. H. Colberg graduated from Technical University, Berlin, in 1943. During the next two years he served with the signal corps of the German Armed Forces. He advanced to the rank of captain in charge of telephone and teleprinter centres at Field Marshal Rommel's Headquarters. After 1945 he did engineering work on telecom-



munications with the German Government Telephones. In 1947 he escaped to Sweden.

Mr. Colberg joined Northern Electric Co. Ltd., Montreal, in 1951 as a project engineer working on the Trans-Canada TD2 microwave system. At present he is a communications specialist for radio systems.

Paper No. 4

A transistorized frequency synthesizer

A description is presented of an instrument providing 30,000 discrete frequencies between 2 and 32 Mc in steps of 1 kc with the stability of the driving frequency standard. It will be shown how any number from 2,000 to 32,000 can be produced from the arithmetic processes of addition, subtraction, multiplication and division, with the most economical use of a set of readily available basic numbers. Practical electronic processes perform

these operations. In particular, use is made of the phase locked loop principle. A variable frequency oscillator (VFO) covers the 2 to 32-Mc range and, for each desired frequency, a suitable arrangement of frequency conversion and filtering allows this VFO to look on a fixed frequency directly derived from the standard. Thus no frequency error exists between the wanted frequency and the standard, since the comparison is

made with a phase discriminator. Also, spurious signals and noise generated respectively by mixers and harmonic generators, are greatly attenuated, since the phase locked loop acts as an "active filter". In particular the "catching range" of an automatic phase control (APC) loop is examined and a method is shown whereby this catching range can be greatly increased by very simple and economical means.

Authors

B. N. Sherman, Canadian Marconi Company

B. N. Sherman received his B.Eng. degree from McGill University in 1947. Two years later he joined Canadian Marconi Co. and worked on the design of high power transmitters in the HF and IF band. Subsequently he was involved in the design and development of radio relay equipment at VHF and UHF. More recently, Mr. Sherman worked on tropospheric scatter SSB systems, and was given responsibility for a comprehensive SSB development program in the HF band.

His present position is Engineer in Charge, Product Development, Commercial Products Division. Mr. Sherman is a Member of IRE.

G. Husson, Canadian Marconi Company

G. Husson received his B.Sc. degree from Faculte des Sciences de Paris, France, in 1955. After graduation he joined Schneder Westinghouse and worked in their research laboratories on the application of transistors to logical circuits. Mr. Husson has been with Canadian Marconi Co., Mont-



Sherman



Husson

real, since 1957, engaged primarily on the design of a frequency synthesizer for SSB equipment.

A two-hop 450-Mc diffraction-plus-scatter system for telephone service

In providing long-distance circuits to Snow Lake and Thompson, Manitoba, two mining towns lying North-East of the Pas, several alternative methods were considered. The best solution appeared to be a two-hop radio relay system originating from Cranberry Portage, a drop repeater on the MTS 2,000-Mc CW20 system between Brandon and Flin Flon. The new system was to consist of a 57-mile over-horizon diffraction path between Cranberry Portage and Snow Lake, and a 103-mile tropospheric forward scatter path between Snow Lake and Thompson.

The equipment chosen was RCA Victor Type MA-5 operating in the 450 to 470-Mc band. This low frequency enabled the same type of RF equipment to be used over both paths. The only differences are in the use of cold standby protection with 40-watt power amplifiers on the diffraction section, while the scatter section uses dual space-diversity with 1-kw

power amplifiers. The antenna system uses 10-ft parabolic dishes mounted on guyed towers at 175 and 300 feet respectively for the diffraction section, and 28-ft parabolic dishes mounted on 100-ft guyed towers for the scatter section.

Baseband interconnections are provided by means of 4-way 4-wire bridges at Cranberry portage and Snow Lake, allowing access to the full 48-channel baseband at all locations. Order wire facilities are derived by means of a Lenkurt single-channel carrier on the radio baseband.

Original performance calculations gave a system noise of 38.5 dba (FLA weighting, zero test level point) in the worst 3-kc channel with the system loaded with white noise. This was based on long-term median signals of 30 microvolts (diffraction section) and 70 microvolts (scatter section) with an equipment noise power ratio of 40 db.

Acceptance tests on this system indicate a median received signal of 30 microvolts on the diffraction section. The scatter section shows a median signal (over one month only) of 35 - 45 microvolts. This may well improve with final orientation. Equipment noise power ratio is approximately 37 db on the diffraction section and 34.5 db on the scatter section. This degradation is due largely to envelope delay distortion at IF, resulting from the narrow IF bandwidths used to obtain a low receiver threshold level. The total system noise at present is therefore several db higher than calculated. Since all multiplex channels on the system are companded, the increased noise is not noticeable under median signal conditions. Should the scatter signal over a long term remain at a median value of 35-45 microvolts, the chief effect would be a reduction of the propagation reliability from 99.95% to 99.5%.

Author

J. C. Gillespie, Manitoba Telephone System

After graduating from the University of Manitoba in 1956 with the degree of B.Sc. in electrical engineering, J. C. Gillespie spent two years in England on an Athlone Fellowship. The first year was spent doing travel-

ing wave tube research, and the second year was spent in industry on VHF and multiplex systems development. He returned to Winnipeg in 1958 and joined the Radio Systems Group, Transmission Engineering Dept. of the Manitoba Telephone System. His present position is Supervising Engineer, Radio Relay Systems.



Paper No. 6

A new electronic tube, the LECTRON

The LECTRON, as its name suggests, is an electronic tube intended for "reading" magnetic tape.

In one method of video recording on magnetic tape, the signals are written and read by crosswise scanning of the tape with multiple high-speed rotating heads.

For many reasons (tape wear, synchronizing difficulties, cost of equipment), it would be advantageous to read the tape by purely electronic means, without the use of high-speed mechanisms. Such a process would also greatly facilitate monitoring and

editing of recorded video programs.

For the above motives, a new electronic tube the LECTRON has been developed in the "Laboratoire d'Electronique Appliquée", Ecole Polytechnique, Montreal.

Other methods have been previously described for reading recorded tape by electronic means, but their use is limited to lengthwise recorded tape.

Our LECTRON involves the action of the recorded dipole fields on a beam of photoelectrons by means of an appropriate electrode arrangement.

A number of prototype LECTRONS have been developed and have shown promising results; the tubes and associated equipment are relatively simple.

We have considered the application of the LECTRON mainly to video recording, but it seems possible that it may also be useful in other fields such as computing and control devices.

The paper will be presented by Mr. J. C. Bernier; Messrs. P. L. Piché and R. P. Langlois will take part in the discussion.

Author

J. C. Bernier, Ecole Polytechnique

Jean-Charles Bernier was born in Montreal and received his higher education from the University of Montreal, Ecole Polytechnique, including an M.A.Sc. in electrical engineering in 1934. After working in various fields of electrical engineering he joined the firm of Villeneuve, Bernier & Leblanc, consulting engi-

neers. Since 1935 he has been a member of the teaching staff at l'Ecole Polytechnique in various functions and is now head of the electrical engineering and engineering physics departments, and director of the "Centre de Recherches de Polytechnique."

Professor Bernier directs the research group of the "Laboratoire d'Electronique Appliquée" which has been active in applied research in the field of electron physics, high vacuum technique, electronic tubes and electromechanical devices.



Professor Bernier is a Senior Member of IRE and a past chairman of the Montreal Section of IRE.

Paper No. 7

An improved design of radio relay equipment in the 132- to 174-Mc range

The 50-watt continuous duty FM radio relay equipment provides an economical transmission facility as alternative to open wire or cable leads. Although originally designed for single-hop circuits, the low distortion of the system (below 1%) and the flat frequency response permit up to ten links to be operated in tandem.

The equipment capability was increased from 4 to 6 high quality voice channels and its efficiency with regard to spectrum utilization was appreciably increased.

This was accomplished by the addition of a special wideband ferrite filter which improved the over-all selectivity of the receiver, thus permitting closer adjacent channel operation.

Channel spacing

The envelope of the sideband interference due to adjacent channel will be derived by the use of Bessel functions. The results will be compared to the sideband interference caused by single channel transmitters for 30 and 60-kc channel separation.

The protective effect of the receiver selectivity will be analyzed. The required relation between the dynamic selectivity curve and the static selectivity curves will be examined. The graph of the receiver selectivity using the 20 db quieting method and the two tone method will be shown, and the merits of the two methods of measuring se-

lectivity will be discussed.

From the curves of the dynamic selectivity and of the envelope of sideband interference a suitable channel spacing will be determined. This will be compared to single channel equipment using 30-kc and 60-kc adjacent channel separation.

Distortion

The problems involved in the design of the modulator and discriminator to obtain low distortion will be indicated.

Some aspects of the specially built 455-kc ferrite filter will be discussed. Its design was based on Bessel characteristics to obtain constant envelope delay and therefore optimum transient response, as the constancy of the envelope delay rather than the actual magnitude of delay determines the filter's ability to pass the desired signals without introducing objectionable distortion.

Front end

The use of a low noise, special quality double triode resulted in an improvement in noise figure. Design considerations for minimum desensitization and intermodulation will be given.

Versatility and reliability

By simple replacement of the baseband amplifier and the ferrite filter with a mechanically identical 30-kc or

60-kc channel filter the equipment can be converted to single-channel operation.

The over-all reliability was increased by the use of special quality tubes; this is particularly important for continuous duty unattended operation.

Conclusion

The improved performance specifications of the system will be summarized and graphs of various system characteristics will be shown.

Author

A. A. Seljak, Philips Electronics Industries Ltd.



Mr. Seljak received his B.A.Sc from the University of Toronto in 1953 and now holds the position of project engineer with the Communications Products Section, Professional Equipment Div., Philips Electronics Industries Ltd., Toronto. He is a Member of IRE.

The transistorized thyatron ring counter

In spite of the fact that many different types of ring counters are presently available, none of these seem to possess all of the features which would make them truly flexible. The characteristics normally sought in a ring counter include: high frequency response, good driving capabilities, and a considerable latitude with respect to the number of possible stages. Add to this the further restriction of low power supply voltages for transistor circuit applications, and virtually all of the currently available types are eliminated.

This paper describes a recently developed ring counter which satisfies the above requirements and others as well.

The bi-stable elements of the "Transistorized Thyatron Ring Counter" are PNP (or NPN) configurations, made up from two separate transistors. Individual transistors were used in these elements so that each stage could be temperature stabilized and so that anti-saturation circuit techniques could be employed. As a result the operation is practically independent of ambient temperature conditions and operating frequencies as high as 1 Mc can be attained with general purpose germanium switching transistors.

The interstage capacitive storage components found in ordinary ring

counters have been replaced by "interstage transistors." This arrangement eliminates the necessity of any capacitors in the circuit whatsoever and allows the upper frequency response of the ring counter to approach the intrinsic capabilities of the particular transistors utilized.

All of the bi-stable elements are connected to a common anode resistor which is selected so that it will pass enough current to sustain conduction in only one stage. Hence, one stage alone can be conducting at a given time and no bias current is demanded from that stage to keep the remaining bi-stable elements nonconducting. Theoretically, then, the number of stages which can be assembled in a single ring is unlimited. (Low considerations do impose a practical limit.)

Since the PNP configuration yields a "thyatron type" operation, each stage is capable of driving a considerable load (approximately 10 ma/stage for the ring counter illustrated.)

An additional feature can be realized when two interstage transistors are employed per stage. If one of these transistors is connected to a preceding stage, and the other to a succeeding stage, the conducting stage can be made to process in either direction. This "backward-forward" operation provides an added facility for

obtaining the difference in numbers of pulses from two sources.

The ring counter described is an all-semiconductor device and as such, will operate on nominal transistor supply voltages. The many operational features, the reproducibility and the already wide acceptance of the "Transistorized Thyatron Ring Counter" indicate a bright future for this unique device.

A patent is being sought.

Author

Joseph A. Pecar,
University of Detroit



Joseph Pecar graduated from Cass Technical High School in 1955. At that time he enrolled at the University of Detroit and participated in the co-operative program in the field of Electrical Engineering. Mr. Pecar received his B.E.E. degree in June of this year.

Paper No. 9

Control of interference between surface microwave and satellite communication systems

Satellite technology is capable of expanding global communication capability by orders of magnitude, but only by sharing frequencies with earth-surface services which now occupy the spectrum. Coexistence principles are here applied to microwave links, as being illustrative of services employing horizontal high-gain antennas in frequency bands of interest. 600-channel active satellites in both stationary and 3,000-mile circular orbits are considered, as well as a 60-channel passive (ECHO-type) system. The assumed minimum elevation for

earth-terminal antennas is ten degrees. Actual antenna patterns are approximated by simpler 3-dimensional "key-holes".

Possible sources of interference are either "surface" (earth terminal to or from microwave) or "orbital" (to, from or via the satellite). All are examined for all three satellite systems and at 2.0 and 6.5 Gc microwave frequencies. Methods of calculating interference levels are illustrated.

The surface problem, of siting high-power low-noise passive-satellite terminals and co-ordinating the adjacent

microwave systems, may be worst, but the vertical angle of terminal antennas prevents main-beam and reduces tropo-scatter interference. For a 16-kw terminal transmission at 2 Gc to be 20 db below microwave receiver noise might require smooth-earth separation of 90 miles, if the terminal is in the microwave main beam. This is reduced to 35 miles if microwave routes are dog-legged so as not to beam at the terminal. Protected terminal sites and local frequency coordination permit reduced separation.

(Continued on page 60)

Summaries — continued

Microwave main-beam interference with satellites can come only from a narrow ring at the satellite's horizon and from only the fraction of stations within this ring having their beams toward the satellite. Such interference would remain below receiver noise even with a 10:1 microwave growth. Integrated sidelobe interference from all stations in sight of the

satellite is even less.

This beam-interference ring for a stationary satellite is **fixed**; an important advantage toward interference control. In fact, from any point on earth there are at most two horizontal directions intersecting the stationary orbit. Even with this orbit eventually filled with satellites, horizontal beam interference can be controlled by pro-

tecting these two directions.

REFERENCE:

1. S. G. Lutz and F. A. Losee, "On the coexistence of celestial and terrestrial communication," Fourth National Aero-Com Symposium, Utica, N.Y., October 1958. Hughes Report No. OP-13, October 1958.

Authors



Firestone



Lutz

W. L. Firestone, Motorola, Inc.

William Firestone began his electronics career as a laboratory technician with Motorola, Inc. in 1940. After a year with the U. S. Navy he started university education in 1943. By 1952 he had obtained his Ph.D from Northwestern University. In the meantime, Dr. Firestone had worked on the design of microwave equipment and an analysis of transmission line directional couplers which resulted in the discovery of many new couplers. In 1956 he was placed in charge of the Applied Research Dept. of Motorola, Inc. where he has contributed to a variety of projects including single sideband communications. In 1960

Dr. Firestone was appointed Director of Engineering, Communications Div., Motorola, Inc.

Dr. Firestone is the holder of several patents on communications equipment, and a number of his papers have been published in technical journals. He is a Member of IRE.

S. G. Lutz, Hughes Aircraft Company

Dr. Lutz began his communications work with Bell Telephone Laboratories in 1929 after receiving his Ph.D from Purdue University. He has been associated with Purdue Research Foundation doing microwave research; Southern Methodist University as assistant professor; Naval Research Labs. as head of measurement and direction finding section; New York University as professor and chairman of EE Dept.; sonar consultant with Edo Corp.

In 1951 Dr. Lutz joined Hughes Aircraft Co. and was appointed senior scientist in the research labs in 1958. He specializes in satellite communications studies. He is a recipient of the U. S. Navy Distinguished Civilian

Service Award.

Jack Smith, General Electric Co.

After serving with the U. S. Navy during World War 2 Jack Smith entered North Carolina State College where he received his BEE degree. Since graduation in 1950 he has been with General Electric Co., initially on the engineering training course, then with the Television Transmitter Section. From 1952 until 1959 he was engaged in the design of television microwave systems. During that time he served on an EIA subcommittee on tv relays to rewrite the standards for tv microwave STL systems. In 1959 he joined the Communications Microwave Section of GE and has been appointed video and RF microwave systems design engineer.

In May of this year Mr. Smith was appointed chairman of an EIA Engineering Subcommittee to prepare testimony and exhibits to be presented to the FCC concerning frequency spectrum needs for space communications above 890 Mc. He is a Member of IRE.

Paper No. 10

New concepts in mobile radio design

Canada's population distribution and our national consciousness have combined to produce a set of communications requirements which are increasingly different from those of the United States.

In recent years, radio licensing and frequency allocation procedures here

have become divergent from U.S. practice, yet remain consistent with good international co-operation.

These factors are producing effects in many ways. Confining ourselves to the VHF mobile radio field, however, some of the more significant effects are as follows:

a) Narrow band point-to-point service is common in the VHF region here, largely confined to the UHF region in the U.S.

b) Complimentary frequency allocations are made along the U.S. border while "individual merit" allocations are made in the interior.

c) The use of multi-frequency systems is common here and rare in the U.S.

d) The emphasis on fringe area performance here, particularly in the prairie mobile radio telephone service.

e) A thrifty interest in low maintenance costs and an increasing market for higher quality communications equipment.

f) A growing need for a compact mobile unit that can be easily adapted to multi-channel systems, used with selective calling and various group calling systems.

An intensive study has been made of service records of a mobile radio system, employing 800 mobile units. This information has led to a systematic evaluation of recurrent faults, and in many cases, sizeable reductions in their rate of occurrence.

The above information has been used to assist in the design of a new mobile unit, which should show a considerable improvement in reliability, over previous units.

Recent trends in automotive styling have led to a versatile packaging arrangement. The new unit can be mounted in one, two, or three sections, the latter two arrangements requiring interconnecting cables. This system permits greater adaptability to the various types of vehicles.

A brief description will be given of the outstanding circuit features of

both transmitter and receiver. These include extensive use of transistors, high receiver sensitivity while maintaining 100 db spurious response attenuation, and a transmitter whose P.A. plate circuit efficiency has been increased to 80% (at 160 Mc).

Multi-channel circuits will be shown, with automatic channel reversion and other system features.

Author

M. A. Robbins,
Canadian Marconi Company



While serving with the Royal Canadian Corps of Signals, M. A. Robbins

was engaged in ionospheric research. After joining Canadian Marconi Co. in 1952 he began work on radar instrumentation, VHF receiver and transmitter design. He became a senior project engineer in 1954, specializing in mobile radio applications and design. His present position is Section Leader in charge of mobile communications engineering at Canadian Marconi Co.

Mr. Robbins graduated from McGill University in 1952 with the degree of B.Eng. in communications. He is a Member of IRE.

Paper No. 11

Siting of microwave systems in a radar environment

The rapid development of radar and microwave relay systems in North America is creating a serious potential interference problem. This paper is based on studies conducted by government agencies and the common carrier companies in Canada over the past two years. A practical approach to the identification and solution of this problem is presented.

Since completely interference-free operation is impractical, acceptable

levels or objectives were determined so that neither system would suffer undue restrictions. Radar and microwave equipment characteristics, as well as system designs, are discussed to illustrate their influence on the interference situation.

A method calculating the anticipated radar interference levels into commercial frequency bands is outlined. Since the calculations are based on several generalizations a realistic

evaluation of results is required, considering such factors as type of emission, frequency separation and growth potential of both systems.

Several interim and permanent solutions to the over-all question are considered, together with examples of their successful application.

Finally, the need for close co-ordination between radar and communication systems is emphasized as a step towards more lasting solutions.

Authors

A. J. Kingan,
The Bell Telephone Co.
of Canada

A. J. Kingan was born in Glace Bay, N.S., and graduated from McGill University in 1958 with a degree of B. Eng., Electrical. Since then he has been with Bell Telephone Co. of Canada, Radio Systems Engineering. His principle work involves studies of interference into the Trans-Canada microwave system from radar and other microwave systems. He is a Member of IRE.

L. W. Dennison,
The Bell Telephone Co.
of Canada

After receiving his B.A.Sc degree in electrical engineering from the University of Toronto in 1955, L. W. Dennison joined the Bell Telephone Co. of Canada. He spent three and a half years in the Radio Division selecting sites for proposed microwave routes. For a year he was on loan to the RCAF as a member of a group conducting studies on interference possibilities between RCAF radar installa-



Kingan



Dennison

tions and commercial microwave communications systems.

Paper No. 12

A solid state selector for teleprinter circuits

The solid state selector was developed to modernize existing teleprinter plant and to permit the use of low cost printers in circuits where selection is required. However, its applications can be extended to include message routing, signal regeneration and others. The circuitry involved has been designed so that the major component of the selector can be used for such applications as error detection where small amounts of computation are involved.

Two basic transistor circuits are used in the selector, the resistance-coupled NOR circuit and flip-flop. These are arranged in groups on printed circuit boards and wired as required for the particular application of the printed circuit connector.

A separate printed circuit board contains the miscellaneous circuits such as the trigger for coupling the line to the selector, the pulse generator for timing amplifiers for driving selector magnets and relays, and a flip-flop and gates for control.

Emitter follower circuits are provided where a large number of NOR circuits are to be driven from one flip-flop and for additional relay drivers.

All circuits were designed using "worst case" methods. That is, all circuits must operate satisfactorily under the worst extremes of all components and voltage at the worst extremes of temperature.

A selector can be divided into three main parts: The control and timing

circuits, a six-bit shift register to convert the serial signal to parallel for use by the selection gates, and finally, the selection circuits. The input and output circuits are included with the control. These are considered in details including circuit and physical design.

Future uses of the basic equipment are also considered. In particular, the details of an error detection system are discussed.

In the design of this type of equipment reliability and error-free operation is paramount. This has been achieved by use of reliable components and using the minimum number of components. The result is a calculated mean time to failure of over two and one half years.

Author

T. G. Rankin,
Canadian Aviation Electronics Ltd.

T. G. Rankin has spent 14 years with the RCAF as a pilot (3 years) and a Telecommunications Officer. He has worked with Computing Devices

of Canada Ltd. as an electronic computer engineer; Adalia Ltd. in their computation service bureau; and with Sperry Gyroscope Co. of Canada Ltd. doing computer design and development. At present, Mr. Rankin is with Canadian Aviation Electronics Ltd., Montreal. He has a B.Eng. degree in electrical engineering.



Paper No. 13

Electromagnetic wave propagation over natural obstacles

Scale model techniques have been developed whereby the effect of natural obstacles on the propagation of electromagnetic waves over the surface of the earth can be investigated within the laboratory. The major advantage of the scale model laboratory experiments has been the ease with which control can be exercised over the pertinent parameters. As a result, the influence of critical factors could

be specifically ascertained.

The influence of obstacle shape (crest and profile) and the effect of the orientation of the radiated electromagnetic fields (angles of incidence and polarization) on the received power, as well as various cross-polarization phenomena have been experimentally determined. Comparisons of diffraction by knife edge, wedge, cylindrical and conical ob-

stacles have been made. For obstacles with sharp crests (e.g., knife edges) there is little distinction between vertically and horizontally polarized fields measured at some distance from the obstacle. Profound polarization effects occur for obstacles with large smooth crests, with vertically polarized fields producing more power at the receiver in all cases. The effect of oblique incidence of

electromagnetic energy on an obstacle is equivalent to changing its radius of curvature by a factor proportional to the square of the secant of the angle of incidence. The distribution of the power behind dominant obstacles has been ascertained.

Theories have been developed for propagation over smooth cylindrical surfaces and generalized to include oblique incidence of the radiation and to surfaces of conical shape. The derivation is based on a generalized concept of the Green's function and on the use of corrective factors from rigorous diffraction theory. The received power is described in terms of a "knife edge" contribution due to the projected outline of the obstacle, and "halo" contributions resulting from the crest of the obstacle. Good agreement between theory and

model measurements is obtained. In some instances, graphs plotted in a

form suitable for practical application have been drawn.

Author

M. P. Bachynski,
RCA Victor Research Labs.



Morrel P. Bachynski graduated in 1952 from the University of Saskatchewan with the degree of B.Eng. in

engineering physics. In the following year he obtained his M.Sc. in physics from U. of S. in the field of radar investigations of the aurora. He then joined Eaton Electronics Research Laboratory, McGill University, where he received his Ph.D. in 1955. He remained there a few months doing research on imaging properties of non-uniformly illuminated microwave lenses. Later that year Dr. Bachynski joined the newly created Research Laboratories of the RCA Victor Co. Ltd., Montreal, and now holds the position of Associate Laboratories Director. He is a Senior Member of IRE.

Paper No. 14

Threshold extension for a quadruple diversity tropospheric scatter system

The IF bandwidth of an FM receiver is normally chosen to give equal intermodulation and thermal noise under average propagation conditions. In a tropospheric scatter system, the received signal level fluctuates violently about the average so that any fixed IF bandwidth will only be the optimum choice for a small proportion of the time. Careful design of circuitry can insure that the intermodulation noise which is controlling during periods of high received signal level is kept within system requirements. In periods of poor propagation the thermal noise will rise sharply and may reach 30db above intermodulation noise. Better overall performance will result if the receiver bandpass can be narrowed as the signal fades to reduce the controlling thermal noise.

While the above argument indicates that a continuously variable IF bandwidth is desirable, the main advantage can be secured by automatically switching to a narrow IF bandwidth when the thermal noise becomes excessive. The reasons for this will be explained. The paper discusses the choice of IF bandwidth for a system carrying 48 multiplex channels on a quadruple diversity scatter link, and describes the receiver block schematic for bandwidth switching on an already existing system.

The choice of the switching point is discussed with graphs illustrating the factors involved in assuring a smooth transition in the voice channel signal-to-noise curve during switching from broad to narrow band.

The paper concludes with exper-

ience obtained during the first installation on the Emeril/Knob Lake path of the Bell Telephone Co. Quebec-Labrador Scatter System.

A tape recording to demonstrate the effect of threshold extension is available.

Authors



Christensen



Wilde

P. S. Christensen,
Northern Electric Co. Ltd.

P. S. Christensen was born in Copenhagen, Denmark, and graduated from Copenhagen Institute of Electrical Engineering with an honors degree in 1956. For the next two years he served as a Technical Lieutenant with the Royal Danish Navy. In 1958 he was employed by the Danish Academy of Technical Sciences, Micro-

wave Laboratory.

In April, 1959, Mr. Christensen joined the Northern Electric Laboratories, Belleville, Ontario, as an associate member of the scientific staff.

J. P. Wilde,
The Bell Telephone Co.
of Canada

J. P. Wilde was born in London, England, and graduated from Northampton Engineering College, London, with an honors degree in electrical engineering in 1952. From then until 1957 Mr. Wilde was employed by F. T. C. Ltd., Ilminster. In 1957 he joined The Bell Telephone Co. of Canada, Toll Area Engineering, Montreal. He is on loan to Northern Electric Laboratories during development of threshold extension principle.

Paper No. 15

High frequency oblique sounding

Since much of Canada lies within the auroral zone, the unstable ionospheric conditions found in this region have determined Canada's particular interest in high-frequency radio propagation. High frequency propagation conditions are normally predicted from vertical soundings of the ionosphere, but because of the great variability of propagation at HF such a system of prediction is not always reliable.

To try and overcome these difficulties DRTE began an oblique sounding program in 1954 which had two main objectives; to check the theory of ionospheric propagation at oblique incidence; and to improve systems of predicting optimum working frequencies.

This program has revealed minor discrepancies in the theory of propagation at oblique incidence and major inadequacies in the assumptions implicit in our prediction systems. Some of the facts revealed by this program are:

1. The maximum usable frequency (MUF) is greater over an oblique path than that which is obtained by extrapolation from vertical soundings.
2. The F_1 layer MUF is often the highest MUF.
3. Single-hop propagation extends far beyond 4,000 km.

4. The high angle mode of propagation is important.
5. E_s , or $E_{sporadic}$, is an important mode of communicating at HF.
6. The lowest usable frequency (luf) is frequently determined by lower layer cut-off.
7. Assumptions as to the distribution of the MUF about the median value are not always valid.

Our present prediction methods can be improved by including the above discrepancies, and plans are already

underway at DRTE to produce such an improved prediction system. Such a system however only provides an improved estimate of median values and does not answer the question as to what is the optimum frequency to operate on at a particular time.

The oblique sounder, by measuring the propagation conditions in parallel with the communication circuit, can provide a measure of propagation conditions in the immediate future and make more reliable communications possible.

Author

**W. L. Hatton,
Defence Research
Telecommunications
Establishment**



Lewis Hatton was born at Trap Lake, B.C., and served with the RCAF during World War 2. From 1941 to

1945 he was attached to the RAF as radar officer in England and the Middle East. He studied electrical engineering at the University of British Columbia, receiving his B.A.Sc. in 1950, and M.A.Sc. in 1951. Mr. Hatton then joined DRTE, Ottawa, where he carried out research on low-frequency atmospheric noise and modulation methods. From 1953 to 1955 he was attached as a lecturer to the Royal Military College of Science, Shrivenham, England. In 1955 he rejoined DRTE where he is now head of the communications systems section of the Communications Laboratory, Ottawa.

Mr. Hatton is a Member of IRE.

Paper No. 16

A variable reactance amplifier for a UHF tropospheric scatter receiver

This paper describes a lower sideband up-converter type of reactance amplifier which was developed for use in a tropospheric scatter receiver. It operates in the UHF band from 750 Mc to 1000 Mc. At any selected

frequency, the bandwidth to the 1-db points is 10 Mc. The conversion power gain of the amplifier is 18 db. The lower sideband signal is converted from X-band to 70 Mc by means of a unitized balanced mixer-preamplifier

which provides an additional 26 db of gain. The over-all noise figure for the receiver is 2 db. An input VSWR of less than 1.2:1 is obtained over a 7 Mc bandwidth through the use of a stripline type signal isolated.

Frequency stability of the signal is independent of pump frequency variations. A crystal controlled local os-

cillator is built into the package along with all the necessary power supplies. A review is given of some of the prob-

lems encountered in adapting a parametric amplifier to an operating receiver system.

Authors

Stanley S. Kostashuk,
Northern Electric Co. Ltd.

Stanley Kostashuk started his electrical engineering education at the University of Alberta, but World War 2 interrupted his studies. He served with the RCAF and RAF as an instructor in basic electronics and radar. Later, he resumed studies at the Uni-



versity of Western Ontario where he received his B.Sc degree in radio physics in 1949. After graduation Mr. Kostashuk joined Northern Electric Co., Communications Equipment Division. When the Research and Development Laboratory was organized in 1958 he joined it and is now laboratory supervisor of the radio communications department. Mr. Kostashuk is a Member of IRE.

Paper No. 17

Lunar and space communications studies

Studies have been carried out at ultra high frequencies of the effects of the medium in cislunar space and of the surface reflection characteristics of the moon on the propagation of electromagnetic waves. The particular application to the use of the moon and artificial satellites as passive communication reflectors is discussed. These studies have been undertaken by the Defence Research Telecommunications Establishment in co-operation with the Lincoln Laboratory of the Massachusetts Institute of Technology and, in part, with the Stanford Research Institute.

Measurements were made of the rotation of the plane of polarization, the fading rates, and the amplitude of the signal received after reflection from the moon during both quiet and disturbed ionospheric conditions.

Of significance in communications

studies is the fading of the received signal due to the libration of the moon. This fading is of the order of cycles per second. When auroral ionization is present along the transmission path, the normal fading rates are greatly increased.

An experiment to determine the bandwidth capabilities of the lunar circuit was then carried out. This consisted of transmitting simultaneously two CW signals having a variable frequency separation. These signals were received after reflection in two independently tuned channels. The frequency separation was determined at which the amplitude of the received signals were no longer correlated.

The results indicate that the correlation coefficient drops off rapidly with frequency separation reaching low values for separations of as little as a few hundred cycles per second.

Thus the useful coherent bandwidth of the circuit appears to be quite narrow because of multipath effects.

Some qualitative experiments have been carried out to investigate the practical application of these results. Transmissions of voice-modulated signals, using both narrow-band frequency modulation and single sideband modulation, have been made from Millstone Hill, near Boston, to Prince Albert, Saskatchewan. Frequency-modulated signals on the moon circuit were characterized by severe distortion, due to the changing multipath reflection properties of the lunar surface. Single sideband transmissions were much more satisfactory. Narrow-band frequency modulation, when used during experiments with the Echo I satellite, did not suffer from the severe distortion which was present on the moon-reflected signal.

Authors



Blevis



Day

B. C. Blevis,
Defence Research Telecommunications Establishment

Dr. Blevis was born in Toronto and received his Ph.D. in physics from U. of T. in 1956. Afterward he joined DRTE in Ottawa where he has been concerned primarily with studies of ionospheric effects on the propagation of UHF radio waves. He is presently leader of the UHF Propagation Group at DRTE. Dr. Blevis is a Member of IRE.

J. W. S. Day,
Defence Research Telecommunications Establishment

Mr. Day was born in Vancouver and received his B.A.Sc. in engineering physics from the University of British Columbia in 1954. Since his graduation he has been associated with DRTE, Ottawa, doing research on UHF propagation in the troposphere and the ionosphere. At present he is a member of the Applied Propagation Section. He is a Member of IRE.

Paper No. 18

CBC television network program delay centre

This paper discusses the geographical problems which prompted the Canadian Broadcasting Corporation early in 1956 to undertake the project of providing an establishment along the coast-to-coast microwave network at which television programs originating in Eastern Canada could be recorded and later replayed to sections of the TV network in other time zones.

The selection of the city and the building location with problems of attendant services are investigated, and available facilities are described.

Decisions which had to be taken regarding the methods to be employed, the quantity and layout of equipment for the proposed centre are discussed.

The system design in its simplest form as mentioned shows how a minimum number of electronic units can be utilized and yet a maximum of operational convenience can be attained. Auxiliary and test equipment which have been installed are mentioned and the uses to which this equipment has been put are described.

The system performance is given

and the results obtained are outlined. Briefly the Video System of the station including the recording process is within ± 3 db up to 2.5 Mc, and is within 10 db at 4 Mc. However this response seems to be relatively less important than the more faithful grey scale reproduction for which the Videotape recorders are noted.

The observance of good engineering practices has assisted in making the performance of the system more than adequate to pass the network signal to the recorder, and to pass

the replayed signal back to the microwave networks without any significant deterioration.

An alternative method of delaying TV programs is indicated and comments on its comparative complexity are mentioned.

The operational problems associated with the recording and double replay of TV programs are outlined and the staff requirements for the entire operation are given. An emergency operational procedure is described for incoming network failure.

Author



G. E. Waters,
Canadian Broadcasting
Corporation

G. E. Waters was born and educated in England. He served with the BBC in their television service in various capacities from 1937 to 1953, except during World War 2 when he served as an Electrical Lieutenant Commander in the Royal Naval Volunteer Reserve and was engaged on antisubmarine work. Mr. Waters emigrated to Canada in 1952 and since 1953 has been a supervising engineer in the Plant Department of the Canadian Broadcasting Corp.

Paper No. 19

Evaluation of the communications systems on the CL-28 Argus aircraft

The RCAF Argus, or the Canadair CL-28, is an aircraft designed primarily for use in anti-submarine warfare. Its complement of communications equipment comprises HF, VHF and UHF equipments with their associated antennas and transmission networks. Equipment and antenna types are shown in Table I.

The purpose of the joint RCAF-Canadair evaluation program was to measure the installation parameters required to assess operational and tactical capabilities of the communications systems. Thus, the following quantities were measured:

a) Antenna impedance versus frequency.

b) antenna directivity patterns over the frequency range.

c) transmission line insertion loss.

d) equipment power output and sensitivity in the aircraft environment.

Using the measured values, system performance was predicted, compared to the specification requirements and,

where possible, corroborated by range trials.

TEST METHODS AND EQUIPMENT

Radiation patterns

For the measurement of antenna horizontal directivity patterns, the aircraft was flown at an altitude of 2,000 feet over a fixed landmark approximately 20 miles from the ground station. The altitude and distance were selected to minimize field strength variations with range¹. Twenty-four headings were flown at 15 deg. intervals, and the received signal strength was recorded when the aircraft passed over the landmark.

Directional couplers and detectors were installed in the transmission lines to monitor the power output of the airborne transmitters. At the same time, altitude gyros and pen recorders were used to record the altitude of the aircraft.

Ground station

A ground station had been established at South Gloucester, Ontario, to test components for the Mid-Canada line. It was ideally suited for the program since it contained UHF, VHF and HF transmitting and receiving equipment, antennas and recorders. Moreover, under the test conditions, the location provided a Fresnel Zone that contained only small obstructions. The receivers were modified to facilitate recording of the AVC voltage as a measure of signal strength.

Range trials

Two-way maximum ranges were determined by listening tests as the aircraft flew radially away from the ground station. Received signal strength was also recorded during aircraft transmissions. Routine aircraft navigation equipment was used to determine aircraft position.

Author

**S. J. Kubina,
Canadair Limited**

S. J. Kubina was born in Smolinske, Czechoslovakia. He received his B.Eng. degree in engineering physics in 1948, and the M.Eng. degree in electrical engineering in 1957, both from McGill University, Montreal.

| Communications System | Equipment Type | Frequency Range MC | Antenna Type |
|----------------------------|----------------|--------------------|------------------|
| High Frequency (HF) | Dual AN/ARC-38 | 2-30 | Wire and Fin-Cap |
| Very High Frequency (VHF) | AN/ARC-502 | 100-156 | AN-104B STUB |
| Ultra High Frequency (UHF) | AN/ARC-552 | 225-400 | AT-256/ARC STUB |

System measurements

Conventional equipment and techniques were used for the measurement of antenna impedances and equipment characteristics. A "diagraph"² and scattering matrix³ methods were used to measure insertion loss.

REQUIREMENTS AND RESULTS

Impedance characteristics of the wire and fin-cap antennas are shown in Figures 4 and 5. The corresponding system efficiencies, shown in Figure 6, conform to the military requirements⁴. Communication with the ground station was obtained at distances up to approximately 2,000 miles.

Ranges of the VHF and UHF systems were essentially line-of-sight for the test altitudes. Predictions of system performance show that the specification^{5, 6} requirements are met.

The correspondence between typical full-scale and model radiation patterns is shown in Figures 7, 8 and 9. The agreement is similar to that shown by Reed and Russel¹ and more recently by Leopard⁷.

Improvements in synchronization between ground and air observations, maintenance of aircraft altitude over

the landmark and the use of statistical techniques should lead to better agreement between predicted and measured values.

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After graduation in 1948 Mr. Kubina worked for Bepco (Canada) Ltd. as a test engineer on electrical switchgear and control equipment. From 1950 to 1952 he was a demonstrator in electrical engineering at McGill University, and did research work on high-current beam switching tubes at Canadian Marconi Co. during the summer of 1951.

In 1952 Mr. Kubina joined Canadair Ltd. where he has worked on radio, radar and radomes. Since 1956 he has been concerned with the evaluation of airborne systems and the development of antennas and radomes. He is presently group leader in the electronics test section of the Avionics Dept. Mr. Kubina is a Member of IRE.

Paper No. 20

Applications for transmission media

Various transmission media are available for communications over short, medium, and long distances. These include wire communications systems as well as radio wave systems. The radio wave systems utilize ground waves, ionospheric reflections, line-of-sight systems, ionospheric and tropospheric scatter, lunar reflections, and space relays of both passive and active types. In wire communications systems are grouped the use of open wire transmission lines, coaxial cable, and broad band TE₀₁ mode, circular cross-section waveguide. The factors which affect the successful exploitation of each of the above media are both technical and economic. As a result, specific areas lend themselves most readily to the use of each medium. In the case of military applications, additional factors in the forms of "military reliabilities" must be considered.

The wire communications systems offer potentially unlimited bandwidths, free from interference, restricted to those regions where the terrain between terminals is readily accessible

and of such geographic condition as to permit installation of the continuous conductor transmission medium, and its maintenance under extreme weather conditions and other possible destructive actions.

The radio wave systems, on the other hand, minimize the right-of-way requirements and the needed land acquisitions, but suffer from the limitations of the available radio frequency spectrum. These limitations are further complicated by the unreliability of the various transmission media as well as interference from natural and man-made sources.

Each type of transmission media described herein will furnish most effective communications in terms of type of service, distances between terminals, geographic conditions and propagation phenomena, under the restrictive economic, technical and "military reliability" requirements. This paper will treat each of the transmission media and propose the conditions under which they can most properly be exploited for maximum effectiveness in a civilian economy and

in terms of "military reliability".

The introduction of space vehicles has brought a new terminal into the communications problem. These terminals move rapidly and at great distances from earth stations, resulting in Doppler shift, Faraday rotation and tracking stabilization problems not found in other operating communications systems. The space age has brought with it the introduction of satellite communications areas well beyond those currently in commercial and military use. It has made possible passive satellites which will serve as reflectors for radio waves, as well as active satellite relays. The latter can provide capabilities for storage and read-out transmissions for communications, as well as instantaneous message repeaters or world wide coverage. These will be examined for those conditions under which they may be employed with maximum effectiveness.

This paper divides the frequency spectrum into categories and proposes conditions for which each portion of the spectrum can best be used.

Author

Joseph H. Vogelmann, Capehart Corporation

Joseph Vogelmann was born in New York and received his B.S. degree from the College of the City of New York in 1940. Later, he received M.S. and Ph.D. degrees from Polytechnic Institute of Brooklyn, both in electrical engineering. Dr. Vogelmann has served with the United States Signal Corps; Watson Laboratories as Chief

of the Development Branch; Chief Engineer in the General Engineering Laboratory at Rome Air Development Centre; Chief of the Electronic Warfare Laboratory directing all research and development in ground-based electronic warfare for the USAF; and Technical Director of the Communications Directorate, USAF. He is now Director of Research and Development at Dynamic Electronics Div., Capehart Corp., Richmond Hill, N.Y.



Dr. Vogelmann was elected a Fellow of IRE in 1959.

Paper No. 21

Data systems

Digital data is normally transmitted over long distances by modifying the characteristics of a sine wave by

modulation techniques. To date, four modulation systems have been proposed: frequency modulation (FM); phase modulation (PM); AM double sideband; AM vestigial sideband.

A feature common to all systems is that the transmitting and receiving terminals must be operated in synchronism. To achieve this, different

synchronizing signals are employed in each modulation system. The performance of these systems is measured by the rate of transmission and rate of error. The signal in any system may be broken into three components:—

"Synchronization" — to indicate word or message separation.

"Data" — or the actual message format.

"Timing" — to mark out successive bit intervals in the signal.

The Vestigial Sideband method was adopted in the SAGE system mainly due to the high transmission rate attainable. In this system the signal is sent over the lines at three different levels and as such is most vulnerable to impulse noise and amplitude variations.

A more rugged system than the rate in this system is in the range of Vestigial Sideband is AM. Double Sideband, the use of which is contemplated in electronic central offices, and perhaps in systems utilizing bandwidths greater than the voice frequency range. Maximum transmission 600 bits/sec.

The most reliable system is Frequency Shift. It has an advantage over AM methods as a result of its immunity to impulse noise and level variations. This modulation method

was adopted for BMEWS, an all-transistorized and highly reliable system. FM systems have a disadvantage in that the maximum transmission rate attainable is about 1,000 bits/sec. The carrier frequency lies in the range of 1,500-1,800 cps and the frequency difference between mark and space must be equal to the bit rate in order to avoid intersymbol interference.

In BMEWS three oscillators are used to derive the three frequencies (carrier, mark, and space).

Development is presently underway on Phase Modulation systems for high speed reliable data transmission. This is achieved mainly by a more effective utilization of the voice frequency bandwidth. In such systems, however, synchronization between transmitter and receiver is absolutely essential.

The systems briefly described herein, and commercial applications of these principles are the basis for the talk on "Data Systems".

Author



P. Pascali,
Northern Electric Co. Ltd.

P. Pascali graduated in electrical engineering from London University, England, in 1957. He joined Northern Electric Co. Ltd., Montreal, in 1959, and has been employed as an engineer in the Toll Transmission Systems Dept. specializing in digital data repeater equipment. Mr. Pascali is a graduate of the Institution of Electrical Engineers, England.

Paper No. 22

Simultaneous transmission and reception with a common antenna

When two or more transmitters or receivers are connected to a common antenna it is necessary to provide a certain amount of isolation between them.

The first problem is to establish the amount of isolation needed over the band of frequencies to be used. This may be done by examining the properties of the transmitters and receivers.

Once the isolation-frequency relationship has been determined, the next problem to be faced is the manner in which the isolating equipment is to be constructed. Here, several possibilities exist, and of these, only those containing solely passive linear

networks are treated. Networks including band-pass, band-stop, low-pass and high-pass filters are described together with the particular advantages and disadvantages of each type.

It is shown that the particular filter type to be used depends, among other things, on the number of transmitters and receivers to be coupled, on the frequency separation between them, and whether the frequencies are to be fixed or variable.

Examples are given of two-channel and eighteen-channel setups, which illustrate the different approaches that can be made to the problems.

In addition, practical information is given on how the various types of

filters may be constructed and used in the various frequency bands from 2 Mc to 10,000 Mc.

An account is given of the difficulties encountered when the frequency separations become very narrow, and of what steps have been taken to overcome them to date. One of the difficulties discussed is that of combining the desirable off-resonant properties of band-pass filter duplexers, with the low insertion-loss properties of the band-reject types. This has been overcome by the use of a hybridizing duplexer which allows a transmitter and a receiver to be operated on one antenna with a spacing of 500 kc in the 150-Mc band.

Author

W. V. Tilston, **Sinclair Radio Laboratories** **Limited**

W. V. Tilston received all his higher education at the University of Toronto, obtaining his Ph.D. degree in applied mathematics in 1951. He served with the Royal Canadian Navy during World War 2, on loan to the

Royal Navy as a radar officer. He has been employed as a demonstrator and research assistant at the University of Toronto, and also worked at the Canadian Naval Laboratory in Ottawa. Dr. Tilston has been with Sinclair Radio Laboratories Ltd. since 1951, and now holds the position of Research Director.



Paper No. 23

An automatic computer-to-computer communication system for voice-band application

Digital communication over long distances using voice frequency facilities imposes severe accuracy, efficiency and cost requirements on these facilities.

An application exists where data must be collected, reduced and transmitted over long distances with an extremely high order of accuracy, speed and reliability. Data from many sources and of varied types is assimilated in several large random-access core storage units located throughout the world. Key data must be transferred between these locations with the probability of error introduced by the transmission system reduced to a minimum. In addition, routine alphanumeric traffic is handled between transmission of key data with less stringent error detecting requirements.

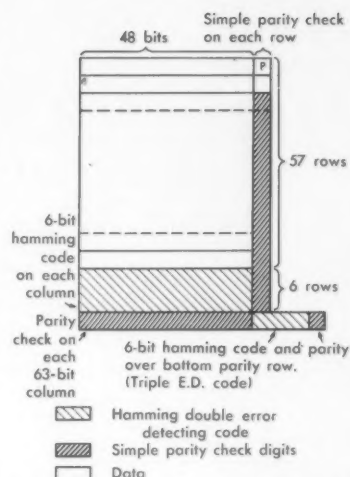
Any system used for this application must reduce the probability of undetected errors entering the system during transmission to a value less than that normally obtained in closed computer systems. The system must also possess a high transmission-line utilization efficiency, and be capable of on-line computer-controlled operation. Feedback verification control is incorporated for automatic message handling and the control of repeating message blocks in error.

The system developed for this application transmits digital data over existing voice-band circuits. Because of the stringent technical requirements, the system incorporates a number of unique features designed to minimize the probability of undetected errors occurring in a severe burst noise environment. The following features are

included, providing an error detecting and verification ability and a transmission efficiency considerably better than that obtained in present commercial systems.

1. An extended error detecting and correcting code is provided, using a two-dimensional block code measuring 49 x 64 bits. The block is capable of detecting any nine errors, regardless of distribution. The probability of undetectable error patterns occurring with errors greater than nine is reduced to a very small value (see figure 1). A distance six code is provided in the vertical dimension, and a distance two in the other.
2. The block code is inherently capable of correction of burst errors up to 48 bits in length.
3. Positive verification of the received block of data must be achieved before the data is accepted. This verification is returned to the transmitter to indicate the error condition of the block received. Positive interpretation of the feedback code must be achieved by the transmitting station before the next block is sent. Any block not passing all checks is automatically repeated.

4. The over-all line utilization efficiency with the above features is 85%, including all coding, feedback and synchronization codes, and message handling information. The data and code bits are placed in a small core storage block similar to figure 1 during transmission, for code generation and checking. Since block transmission occurs on a row



Hamming column double error detecting code and parity (with triple error detecting quality assurance check on column parity), yields an effective quintuple error detecting code per column. Row parity increases error detecting capability on block to any nine errors.

Figure 1.

basis, and the distance six code is on the columns, the data bits and corresponding parity check bits are separated in real time on the transmission line by 49 bit-times. Multiple errors in one code check group column due to burst noise are reduced considerably with this technique.

The system operates with several commercially available modulators provided for voice frequency use. The synchronization and timing of the two stations is not dependent on the modulator used.

Authors

David N. Lytle,
Beckman Instruments, Inc.

Mr. Lytle received a B.M.E. degree from the General Motors Institute in 1953, and studied electrical engineering at the University of California in 1957, and at Stanford University in 1959-60. He has worked with General Motors Corp. electromotive division, and served in the United States

Navy as an officer on submarine duty. In 1957-59 he was employed by Beckman Instruments, Inc., systems division; from 1959-60 he was on the staff of Stanford Research Institute where he was working on airborne digital electronic control systems.

In March, 1960, Mr. Lytle joined the Palo Alto Laboratory of Beckman Instruments, Inc., Systems Div., where he is engaged in the study of digital



Lytle



Ellsworth

transmission techniques for special system applications.

**R. L. Ellsworth,
Lockheed Aircraft Corp.**

Mr. Ellsworth received a B.S. degree in electrical engineering from the University of California in 1949. From 1950 until 1952 he was employ-

ed by the San Francisco Naval Shipyard electronics office as a sonar project engineer. The following year he worked with Marchant Research, Inc. From 1953 until 1957 Mr. Ellsworth was employed by Beckman Instruments, Berkeley Div., as a project engineer where he worked on the design and development of digital counting

and timing equipment. The following year was spent doing logical design of digital telemetry systems.

In 1958 Mr. Ellsworth joined the staff of Lockheed Missiles and Space Div. where he is presently employed in digital equipment development for computer and communication applications.

Paper No. 24

Phased array communications

Phased array communication systems offer advantages of flexibility, high-power capability, hardening capability, and equipment reliability required by future military and commercial systems. They provide unique

solutions to problems presented by tropospheric scatter communication, satellite communication and data readout, satellite or moon relay, and various other communication requirements.

The phased array system provides multiple electronically-formed and electronically-steered antenna beams controlled by progressive phase shift over the array. Multiple transmitters and receivers are employed.

Author

**V. E. Trintner,
Bendix Corporation**

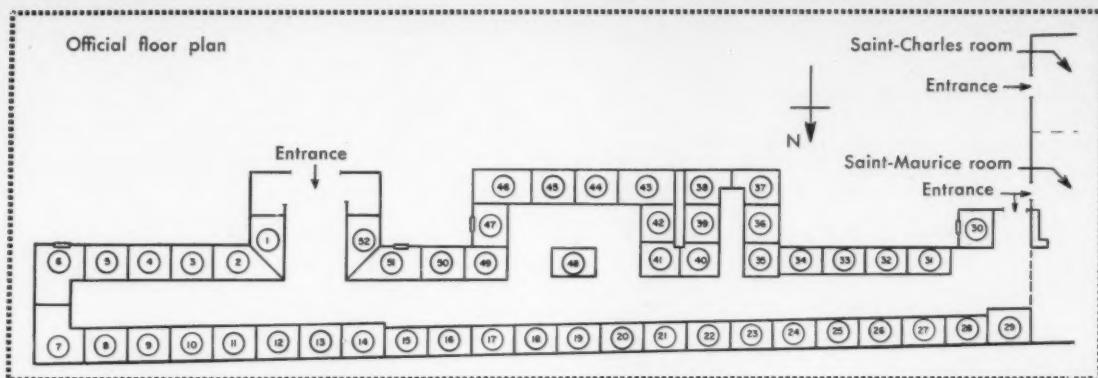
V. E. Trintner graduated from the United States Military Academy in 1943. He attended the Harvard-MIT Radar School while in the Army and

later did graduate work in communication electronics at Ohio State. Mr. Trintner has worked with Curtiss-Wright Corp. on missile guidance systems; Philco Corp. on design of microwave antennas and components; and Martin Company on a wide variety of

electronic systems.

Mr. Trintner is presently an electronic systems engineer with Bendix Radio, Baltimore, where he is in charge of a company-sponsored study of phased array communication. He is a Senior Member of IRE.

NOTES



Thirty-nine exhibitors will be there

Alphabetical list with their booth numbers

| | | | |
|---|-------|--|----------|
| Aeromotive Engineering Products Ltd., Pointe Claire, Que. | 15 | Electronics and Communications, Toronto 9, Ont. (Age Publications Ltd.) | 41 |
| Alfax Paper & Engineering Co., Westboro, Mass. | 38-39 | The Institute of Radio Engineers Inc., New York, N.Y. | 30 |
| Ampex of Canada Ltd., Ottawa | 1-2 | Instronics Ltd., Stittsville, Ont. | 52 |
| Andrew Antenna Corp. Ltd., Whitby, Ont. | 3 | Kay Electric Co., Pine Brook, N.J. | 25 |
| Atlas Instrument Corp. Ltd., Toronto 19, Ont. ... | 11-12 | E. G. Lomas, Ottawa 4, Ont. | 45 |
| Automatic Electric Sales (Canada) Ltd., Toronto 16, Ont. | 4-5 | McCurdy Radio Industries Ltd., Toronto 1, Ont. ... | 6 |
| Bach-Simpson Ltd., London, Ont. | 29 | Microwave Systems, Scarborough, Ont. | 43 |
| Barnard Stamp & Stencil Ltd., Hamilton, Ont. | 32 | Northern Electric Co. Ltd., Montreal, Que. ... | 49-50-51 |
| Beatty Bros. Ltd., Fergus, Ont. | 23 | Payette Radio Co. Ltd., Montreal, Que. | 7 |
| Belden Mfg. Co., Chicago, Ill. | 24 | Potter & Brumfield Canada Ltd., Guelph, Ont. | 31 |
| Boston Insulated Wire & Cable Co. Ltd., Hamilton.. | 16 | Prentice-Hall Inc., Englewood Cliffs, N.J. | 37 |
| Camloc Fastener Corp., Paramus, N.J. | 42 | Pye Canada Ltd., Montreal, Que. | 40 |
| Canadian Electrical Supply Co. Ltd., Montreal, Que. | 19-20 | RCA Victor Co. Ltd., Montreal, Que. | 13-14 |
| Canadian Electronics Engineering, Toronto 2, Ont. (Maclean-Hunter Publishing Co. Ltd.) | 35 | R-O-R Associates Ltd., Don Mills, Ont. | 21-22 |
| Canadian Westinghouse Co. Ltd., Hamilton, Ont. ... | 9-10 | Radio Engineering Products Ltd., Montreal | 26 |
| Allan Crawford Associates Ltd., Willowdale, Ont. | 33-34 | Radionics Ltd., Montreal 9, Que. | 17-18 |
| Eitel-McCullough Inc., San Carlos, Calif. | 8 | Sigma Instruments Inc., South Braintree, Mass. ... | 47 |
| Electrodesign, Montreal, Que. | 27-28 | A. C. Simmonds & Sons Ltd., Toronto 7, Ont. | 36 |
| | | Sinclair Radio Laboratories Ltd., Downsview, Ont. ... | 44 |
| | | Spaulding Fibre of Canada Ltd., Toronto 18, Ont. ... | 48 |
| | | Whittaker Electronics Ltd., Ottawa 1, Ont. | 46 |

What the exhibitors are showing

- **Name**
- **Address**
- **Booth**
- **People**
- **Principals**
- **Products**

† indicates IRE member
* indicates new product

Aeromotive Engineering Products Ltd.,
147 Hymus Blvd., Pointe Claire, Que.
Booth 15

N. Silberberg, K. Tucker, S. Galloway.
Central Dynamics Ltd., Unimax Switch Co.,
James Cunningham Son & Co. Inc., Non-Linear Systems Inc., Westport Electric Inc.,
Irlon & Vosseler, Hoffman Electronics Corp.,
Potter & Brumfield Canada Ltd.

Instruments: digital voltmeters with accessories such as ac/dc converters and preamplifiers, frequency counters, time interval meters, mechanical and electrical counters including printing counters. Components: relays, crossbar and other switches, capacitors, semiconductor devices, panel meters, meter relays, etc. Equipment: custom built electronic controls, especially servo controls; transistorized compression amplifier*, audio-switcher*, video distribution amplifier*.

Alfax Paper & Engineering Co.,
P.O. Box 125, Westboro, Mass.
Booth 38-39

S. C. Sviokla, M. Alden, J. Alden, L. Farrington, E. D. Cross.

Own products.

Alfax electrosensitive recording paper, which uses electricity as the ink. Recordings are sepia for faster eye/brain interpretation; high speed makes pulse presentations immediately available for interpretation. Demonstrations will include use of Alfax paper in precision graphic recorders operating from 3 ips to 500 ips; stylus recorders with broad electrode showing millimicrosecond pulses; helix recorders for any timed pulse.

Ampex of Canada Ltd.,
607 Commonwealth Building, Ottawa,

Booth 1-2

Ed Koller†, James E. Detlor, Tony Beddow, Charles Worth†, Gene Brandeis†.

Own products.

Amplex instrumentation recording equipment and accessories, including the AR-300/FR-700 wideband recording system*; the CP-100 7- or 14-channel extended frequency recorder/reproducer*; the FR-600 advanced analog recorder; the FR-100B general purpose analog recorder; and a full line of instrumentation and computer tape.

Andrew Antenna Corp. Ltd.,
606 Beech St., Whitby, Ont.

Booth 3

R. P. Matthews†, J. C. Annett†.

Own products.

Representative equipment from Andrew's complete line of antennas and RF transmission lines will be displayed. Included will be a dual-polarized, 4-ft diameter parabolic antenna and mount, for microwave systems; a scale model of the HUBLOC 28-ft diameter parabolic reflector, showing the construction principles used; production models of a new line of base station antennas for both unity and medium gain; and HELIAX flexible copper coaxial cables from 3/8 to 3 1/2 in. diameter.

Atlas Instrument Corp. Ltd.,
50 Wingold Ave., Toronto 19, Ont.

Booth 11-12

F. W. Sargeant, L. Bradford, A. L. Rosenthal†, B. Feldman†.

Hewlett-Packard Co., Gertsch Products Inc., Sierra Electronic Corp., Kintel, Massa, Tel-Instrument Electronics Inc., Dymec Inc., Electro Products Labs. Inc., Skydye Inc., Eric A. Lindgren & Associates.

Electronic measurement instruments of laboratory quality, specifically intended for use in the communications industry. These will include instruments for the measurement of frequency, RF power, carrier frequency spectrum analysis, telephone frequency voltages and currents, as required in communications research, development and application. Latest advances will be featured, many in active demonstrations, including Sierra's 125A frequency selective voltmeter*; Hewlett-Packard's 113AR frequency divider and clock*, 185A 'scope, 100ER frequency standard, 524D counter, 525C converter, 540B transfer oscillator; and Gertsch's FM-7/DM-3 frequency meter with peak modulation deviation meter*.

Automatic Electric Sales (Canada) Ltd.,
185 Bartley Dr., Toronto 16, Ont.

Booth 4-5

C. L. Littler, R. C. Fawcett, E. E. Hucal, A. C. Stewart†, R. McCracken, R. A. Oliver.

Automatic Electric (Canada) Ltd., Lenkurt Electric Co. of Canada Ltd., Lorain Products (Canada) Ltd., Electronic Secretary Industries Inc., Tel Autograph Corp.

Automatic Electric AT-2 and AT-3 repeaters, and telephone type relays, including the Class W wire spring relay*; Lenkurt 71A light-route radio systems*, 81A exchange carrier, and 54A urgent alarm and supervisory system*; Lorain FLOTROL power supply units; Electronic Secretary telephone answering units; and Teltautovision industrial closed circuit television equipment.

Bach-Simpson Ltd.,
P.O. Box 484, London, Ont.

Booth 29

G. F. Bates, H. Leah†.

Own products.

Panel instruments, test equipment and accessories, featuring Controller-Indicator Systems*, an extension of the Frequency Controller which won the component award at the 1959 IRE Canadian Convention.

Barnard Stamp & Stencil Ltd.,
8 George St., P.O. Box 295, Hamilton.

Booth 32

R. W. S. Freeman, R. F. O'Connor.

Relifax Ltd.

Printing equipment, inks and accessories suitable for marking capacitors, fuses, relays, resistors, transformers, transistors, tubes, etc. The line includes hand-operated, semi-automatic and fully-automatic models; printing plates and type; air drying and special ceramic inks. The new Model 555 Mark II high speed rotary printing machine will be featured*.

Beatty Bros. Limited,
Fergus, Ont.

Booth 23

A. A. Royle, R. M. Cuddy.

Own products.

Guyed masts, H-masts, and self-supporting masts, now available in heights up to 400 ft*.

Belden Mfg. Co.,
Chicago 80, Ill.

Booth 24

J. F. Olson, F. Timmons, M. Scott (Belden); W. H. Newport (White Radio, Hamilton, Ont.)

Own products.

Wide range of electronic wires and cables. New products include miniature microphone cables with cadmium-bronze stranded conductors*, miniature broadcast and audio cables*, multiple-pair individually shielded cables*, coiled test prod wire*, coiled 4-conductor microphone cable*, and 51-pair unshielded intercom cable*.

Boston Insulated Wire & Cable Co. Ltd.,
118 Shaw St., Hamilton, Ont.

Booth 16

Alden C. Davis, R. F. Berner, Stanley Wolkowski, Edward McCusker, William G. Martin.

Own products.

Teflon, silicone rubber, vinyl, polyethylene, neoprene, natural and synthetic rubber insulated and jacketed cables meeting U.L., C.S.A., and military specifications. Coaxial, high and low temperature, water pressure resistant, and rough usage cables for missile, radiation resistant, and special electronic applications. Elevator cables. New high voltage and high performance cables will be featured*.

Camloc Fastener Corp.,
22 Spring Valley Rd., Paramus, N.J.

Booth 42

Bennet F. Becker, Herbert F. Peppel.

Own products.

Complete line of quarter-turn fasteners, chassis and container latches, featuring the new sub-miniature quarter-turn fastener and single-hole mount receptacle*, and the new 37L, 46L, and 51L container latches*.

Canadian Electrical Supply Co. Ltd.,
275 Craig St. West, Montreal, Que.

Booth 19-20

Arnold Goodman, Joe Pascal, Paul Zuk†, John Sawatsky†.

Texas Instruments Incorporated.

Broad line of semiconductors, including industrial, consumer, and special computer germanium transistors; high-power, power, small signal, and switching silicon transistors; resistors, "sensitive" silicon resistors, and "tan-TI-cap" tantalum capacitors. The display will feature the new SOLID CIRCUIT semi-conductor networks*.

Canadian Electronics Engineering,
481 University Ave., Toronto 2, Ont.

(Maclean-Hunter Publishing Co. Ltd.)

Booth 35

C. A. King, Harold Price†, I. R. Dutton†, R. E. Swan, K. E. Winchcombe.

Own products.

The technical publication serving Canada's electronics industry in management, research, design and application. Published monthly on the 4th, Industry Review and Forecast in January; New Products Review in March; Components and Equipment Directory in June; PRE-IRE Canadian Convention issue in October.

Canadian Westinghouse Co. Ltd.,
Electronics Div., Box 510, Hamilton, Ont.

Booth 9-10

K. Jenner, E. M. Hepburn, G. H. Pope, A. J. Lipinski, W. W. Fines.

Own products.

MICROSCATTER low-cost long-range tropospheric scatter communications systems for transmission of radar data or two-way voice (120 channels) and teletype messages up to 200 miles without relay stations. Power—2 kw; frequency—4400-5000 Mc; antennas—10-28 ft diameter. Suitable for mounting in standard truck trailers, or setting down by helicopter in remote locations.

Allan Crawford Associates Ltd.,
5590 Yonge St., Willowdale, Ont.

Booth 33-34

A. R. Crawford, G. Singer, W. D. Jordon, J. H. Smiley, G. Micklewright, O. Padgett, J. Zevenbergen.

Weinschel Engrg. & Mfg. Corp., Pittometer Log Corp., Electronic Associates Inc., The John Fluke Mfg. Co., etc.

Waveform synthesizers, PCM synthesizers, fast risetime pulse generators, X-Y plotters, digital voltmeters, analog computers showing Fresnel zone synthesis, differential voltmeters, power supplies, impedance bridges, ferrite isolators and other ferrite devices, guidance antennas, coaxial attenuators, terminations, attenuation measuring equipment.

Eitel-McCullough, Inc.,
301 Industrial Way, San Carlos, Calif.

Booth 8

R. D. B. Sheppard, P. T. Kerwin, F. A. Speaks, G. Badger, C. Warner.

Own products.

Typical examples from the complete line of Elmac electron power tubes, super-power klystrons, ceramic negative grid and reflex klystrons, ceramic traveling wave and transmitting tubes. Display will feature the new X-778 traveling wave tube*, 3CX10000A3 ceramic negative grid tube*, and a new high-power klystron.

Electrodesign,

9124 St. Lawrence Blvd., Montreal 11, Que.

Booth 27-28

H. H. Schwartz†, A. Rosenblum†, W. Gasoff†, Frank Segal, P. Spence-Thomas. E.S.C., Van Norman Industries Inc., Syston Corp., Metrawatt A.G., Bogart Mfg. Corp., Chassis-Trak Inc.

Distributed and lumped constant, and variable delay lines; wideband transformers; signal generators; VHF and UHF sweep frequency generators; frequency counter-timers; digital printers, oscillators, and voltmeters; analog recorders; meters; insulation testers; telemetry apparatus; waveguides; dummy loads; waveguide switches and filters; directional couplers; miniaturized high-power T switches; coaxial switches; broadband antennas; parametric amplifiers; chassis slides.

Electronics and Communications,

450 Alliance Ave., Toronto 9, Ont.

(Age Publications Ltd.)

Booth 41

T. W. Lazenby†, H. E. Dally†, D. Reynolds, J. R. Graham, Miss D. K. Trowell.

Own products.

Electronics and Communications magazine—Canada's pioneer journal in the field of electronics and communications engineering.

The Institute of Radio Engineers, Inc.,
72 West 45th St., New York 36, N.Y.

Booth 30

William C. Copp†, Herbert A. White†.

Own products.

Publications of IRE, including Proceedings, Directory, Standards, and Transactions of Professional Groups; IRE emblems, pins, and membership information.

Instronics Limited,

P.O. Box 100, Stittsville, Ont.

Booth 52

John E. Knowles, Ronald W. Price, Douglas E. Leach.

Racal Engineering Ltd., Kahn Labs. Inc., Balun Ltd., Lavoie Labs. Inc.

Communications equipment and instrumentation, including Racal receivers and portable transmitter receivers; Kahn voice multiplex system and SSB receiver/adaptor; Lavoie synthesizer frequency meter.

Kay Electric Co.,

14 Maple Ave., Pine Brook, N.J.

Booth 25

Thomas Dougherty.

Own products.

Ligna-Sweep Model SKV audio, video and VHF sweeping oscillator*; Thermo-Node wide-range noise source*.

E. G. Lomas,

227 Laurier Ave. W., Ottawa, Ont.

Booth 45

E. G. Lomas†.

Co-operative Industries Inc., Delta-F Inc., Lei Inc., Microwave Associates Inc., Pacific Semiconductors Inc., Power Sources Inc.

Flexible waveguide, diodes and varactors, mixer-preamplifier assemblies, IF amplifiers, receivers, Varicaps, solid-state harmonic generators, transistorized crystal oscillators, new Sineverter solid-state sine-wave inverters for continuous duty or emergency power supply*.

McCurdy Radio Industries Ltd.,

22 Front St. W., Toronto, Ont.

Booth 6

G. E. McCurdy†, Ken MacKenzie†, Norm Farr.

Own products.

Audio equipment for the broadcast, television and motion picture industries, including two new audio consoles for use in television stations*, and a new transistorized intercom system for television programme production*.

(Continued on page 74)

Exhibits

† indicates IRE member

* indicates new product

Microwave Systems,
46 Crockford Blvd., Scarborough, Ont.
Booth 43

G. G. Cooper, H. H. Emker, T. P. Matthews

Radio Frequency Labs, Inc., Technicraft Div. of Electronic Specialty Co., Antlab Inc., Cascade Research Div. of Monogram Precision Industries Inc.

Frequency-shift and tone on-off terminals for telegraph, control and telemetering*; electronic telegraph repeaters; voice amplifiers; rigid and flexible waveguide; high temperature RF coaxial cable*; ferrite devices and other microwave components; polar and rectangular recorders; power-driven antenna mounts.

Northern Electric Co. Ltd.,
1600 Dorchester St. W., Montreal, Que.
Booth 49-50-51

Engineering and sales personnel from the divisions whose products will be shown.

Own products.

Parametric amplifier; video distribution amplifier; 8-in. and 17-in. video monitors; E-6 repeater plug-in unit; N-450 radio relay system; architect's model of new Research and Development Laboratories buildings and grounds; typical semiconductor devices made by N.E. Co.; enlarged models of semiconductor devices; photographs of some of the more sophisticated equipment used in semiconductor manufacture.

Payette Radio Ltd.,
730 St. James St. W., Montreal 3, Que.
Booth 7

W. G. Garnham.

Servisol Ltd., All Power Transformers, Panduit Corp., Birnbach Radio Co., Rimak Inc., Potter & Brumfield Canada Ltd., Spectrol Electronic Corp., Dymo Corp., Ohmite Mfg. Co. Contact cleaner, components, precision potentiometers, breadboards, embossing machines, conduit, insulating tapes, relays, resistors.

Potter & Brumfield Canada Ltd.,
135 Oxford St., Guelph, Ont.
Booth 31

Alan Laws, Ken Tucker, Norm Silberberg.

Own products.

Wide range of electro-magnetic relays of the following types: power, telephone, general purpose, sensitive, and special purpose. Two new relays will be shown for the first time*.

Prentice-Hall Inc.,
Englewood Cliffs, N.J.

Booth 37

Wallace Matheson, Gerard Haldin, John Davis.

Own products.

Complete display of the latest Prentice-Hall technical and reference books in electronics and

allied fields. Valuable reference material will be featured, including the **ENCYCLOPEDIA OF ELECTRONICS AND NUCLEAR ENGINEERING** by Dr. Robert I. Sarbacher. This publication contains all modern terms and definitions, equipments, elements, components, and systems in the electronics and nuclear engineering fields.

Pye Canada Ltd.,
84 Northline Rd., Toronto 16, Ont.

Booth 40

A. J. Capstick†, F. F. Richa†, D. L. Thibodeau†.

Own products.

VHF mobile and fixed radio equipment; portable loud-speaking equipment; test equipment, including the new insertion loss scanner Model PTC1206*.

RCA Victor Company, Ltd.,
1001 Lenoir St., Montreal 3, Que.

Booth 13-14

George House, Ken Logan, Doug Michel.

Own products.

Broadband microwave systems; automatic telephone equipment; telephone multiplex equipment; supervisory systems employing solid-state devices; new data communication systems for business*; new industrial computer systems*.

R-O-R Associates Ltd.,
1470 Don Mills Rd., Don Mills, Ont.

Booth 21-22

J. S. Root, W. Hastings, E. J. Wootten. Varian Associates of Canada Ltd., Hughes Aircraft Co., Sanborn Co., A/S Bruel & Kjaer, Wandel & Goltermann, Berkeley Div. of Beckman Instruments Inc.

Microwave tubes, including new CW klystrons for communications links*; new 10-Mc EPUT meter and universal counter/timer*; transfer oscillator for direct-reading frequency measurements from dc to 21 Gc; new wide-range variable-selectivity wave analyzer, coupled with new graphic level recorder*; new 1-in. and 1/2-in. diameter precision condenser microphones*; new Model 2D X-Y recorder*; new wobble system for automatic spectrum analysis*.

Radio Engineering Products Ltd.,
1410 Stanley St., Montreal, Que.

Booth 26

H. A. Robinson†.

Own products.

Four-channel and 24-channel miniaturized military telephone carrier terminals.

Radionics Ltd.,
8230 Maynard St., Montreal, Que.

Booth 17-18

S. H. Ungar, G. G. Beyroudy, H. Watson, J. Lastra.

Airborne Instruments Lab., FXR Inc., Huggins Labs., Analab Instrument Corp., Transistor Specialties Inc.

ALL receiver and antenna test equipment, including noise generators such as the new Type 70*, automatic noise figure indicators, precision IF test receivers, microwave and video crystal testers. FXR microwave components and test equipment, including ferrite isolators, coaxial couplers and attenuators, precision attenuators, frequency meters, power meters, waveguide switches, sweep signal generators, and featuring several new products*. Huggins permanent magnet-focused, solenoid-focused, and electro-

statically-focused traveling wave tubes, featuring the new model HA-58 which won an award for Industrial Design at the 1960 Wescon Show*. Analab Model 1100/700 dual-channel plug-in "scope". Transistor Specialties Model 361 transistorized 1-Mc counter-timer*.

Sigma Instruments, Inc.,
c/o D. T. Shaw Co.,
2340 Lucerne Rd., Montreal 16, Que.

Booth 47

Frank Buridge, Don Stewart, Doug Shaw.

Own products.

High speed polar relays for relaying pulses; 60 and 400 cps magnetic amplifier relays; Cyclone stepping or impulse motor; new Series 9C Cycloswitch stepping switch incorporating flush-printed switch decks*.

A. C. Simmonds & Sons Ltd.,
100 Merton St., Toronto 7, Ont.

Booth 36

D. S. Simmonds, G. D. Pettifer.

P. R. Mallory & Co. Inc., E. F. Johnson Co., Shure Bros. Inc., Guardian Electric Co./Carriere & MacFeters Ltd., Ohmite Mfg. Co.

Premium grade electrolytic capacitors, tantalum capacitors, silicon rectifiers*; tube sockets, variable capacitors, inductors, etc.; mobile communications microphones; relays, solenoids, stepping switches; rheostats, precision resistors, etc.

Sinclair Radio Laboratories Ltd.,
21 Toro Rd., Downsview, Ont.

Booth 44

P. Yachimec†, W. V. Tilston†, A. H. Secord†.

Own products.

Antennas, filters, duplexers, antenna test sets, transistor guard; featuring the new Models 227 and 228 corner reflector antennas*.

Spaulding Fibre of Canada Ltd.,
70 Coronet Rd., Toronto 18, Ont.

Booth 48

M. P. Komar, V. Christensen, J. Kelly D. Kearney.

Own products.

Vulcanized fibre, Armitte, Spauldite laminated thermosetting plastics, Spauldite, and fibreboards. Display will feature the new G11-820 grade copper-clad laminate*, and XXXP-770 cold-punching flame retardant paper base laminate*.

Whittaker Electronics Ltd.,
2137 Niagara Dr., Ottawa 1, Ont.

Booth 46

E. E. Whittaker.

Dressen-Barnes Corp., Panoramic Radio Products Inc., Spectrol Electronics Corp., Winchester Electronics Inc., Gudebrod Bros. Silk Co. Inc., Moletronics Inc., Dynamic Gear Co. Inc., Specific Products, P.B.R. Mfg. Co., Telonic Industries Inc., Skiatron Electronics & TV Corp., International Instruments Inc.

Components: rack and panel connectors, precision potentiometers and dials, lacing tapes, precision gears and clutches, sub-miniature meters and switches, microwave components. Instruments: spectrum analyzers, WWV receivers, power supplies, "scopes, dollies, sweep generators, digital voltmeters, featuring the Skiatron SK1001 storage oscilloscope* and the Panoramic LP-1a sonic spectrum analyzer*.

NOTES

See these at the show

Latest developments will be on display

Many exhibitors will take advantage of the opportunity presented by this important symposium to introduce new components and equipment. Here is a cross-section of these new products compiled by the editors of Canadian

Electronics Engineering, to further help you plan your visit to the 1960 Canadian Symposium on Communications. If you want further information on any of these products, use the Reader Service Card on page 105.

Audio control consoles

100

SS4500 and SS4600 tv audio control consoles provide complete audio distribution and control facilities for television programming, and are designed for maximum operating efficiency and convenience. SS4600 (illustrated) accepts up to twelve simultaneous inputs, which may be fed singly or in any combination to two master outputs, either directly or via three sub-master channels. Crossbar switching of all sub-master and master inputs, plus complete jackfield facilities, results in flexibility and permits almost limitless number of input-output configurations. Model SS4500 will process twenty simultaneous inputs from a total of forty sources.

McCurdy Radio Industries Ltd. Booth 6



Corner reflecting antennas

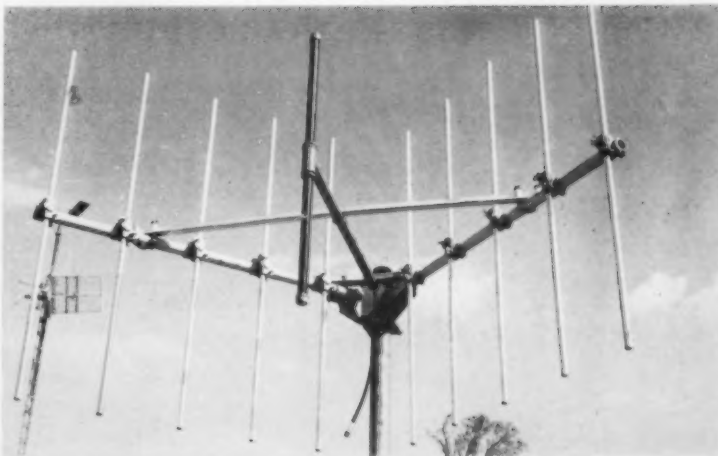
101

Two corner reflectors have been designed for the 150-174 Mc range for use where a high front-to-back ratio is required. Impedance and pattern are not seriously affected by icing. The feed dipoles are completely enclosed in plastic radomes and VSWR is low over the operating frequency range. Model 227 (illustrated) has a pattern beamwidth in the E-plane of 56 degrees and in the H-plane it is 50 degrees. Gain over a half wave dipole is 7.5 db.

Model 228 has a pattern beamwidth of 43 degrees in the E-plane and 36 degrees in the H-plane. Gain over a half wave dipole is 10.5 db.

Sinclair Radio Labs Ltd.

Booth 44



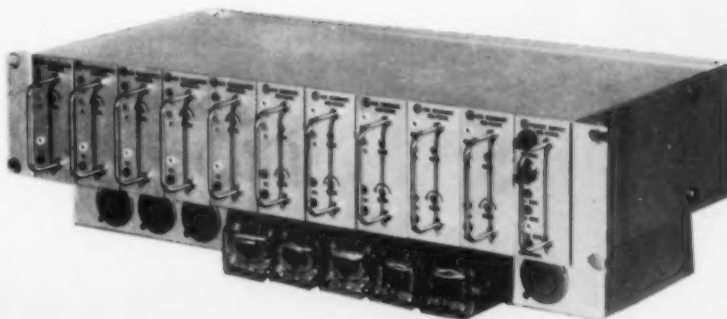
Audio tones

102

RFL series 2056 audio tones features plug-in card construction with each channel terminated with a strip at the rear of the frame. The channel frequency determining components are also of the plug-in type and are mounted directly on the channel plug-in assembly in AM units, and adjacent to plug-in assemblies on the FSK units. The AM series of tones was designed for signaling and control requirements with low noise lines and circuits in voice channels. The FSK tones are designed for high reliability and can be used in circuits which are inherently noisy and which are subject to fading conditions.

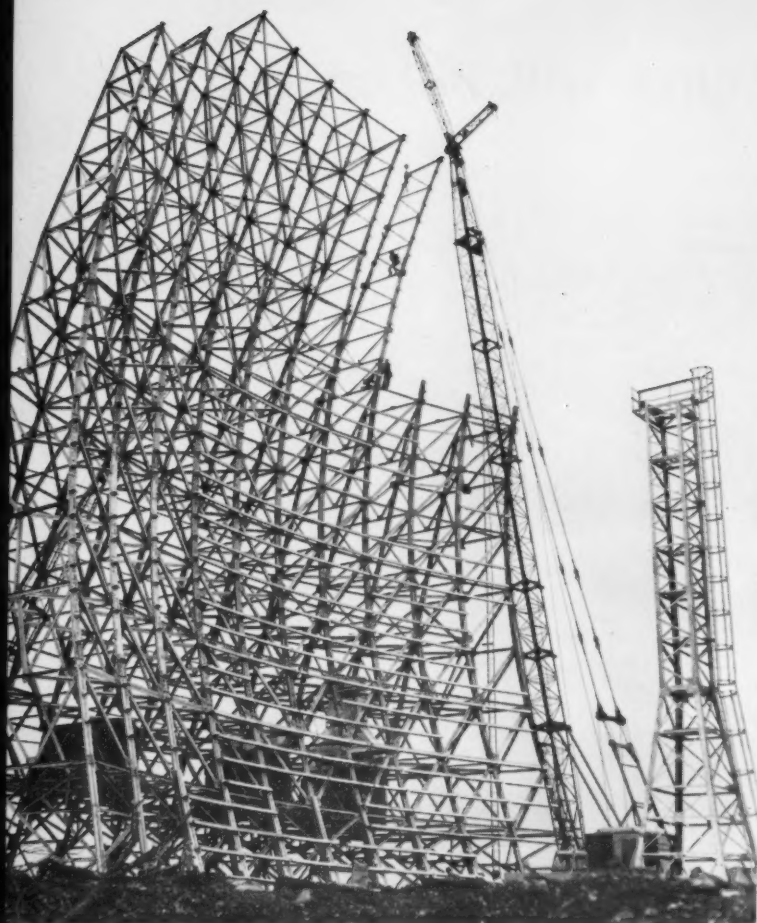
Microwave Systems

Booth 43

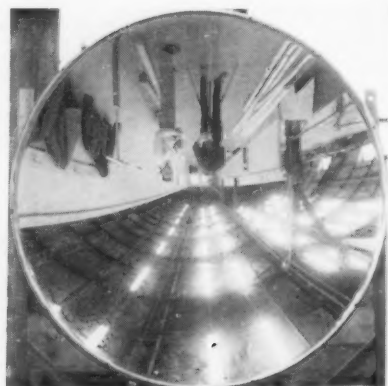


(Continued on page 85)

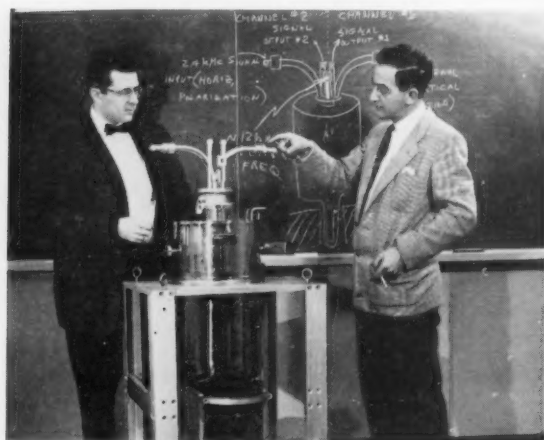
Antennas play vital role in communications



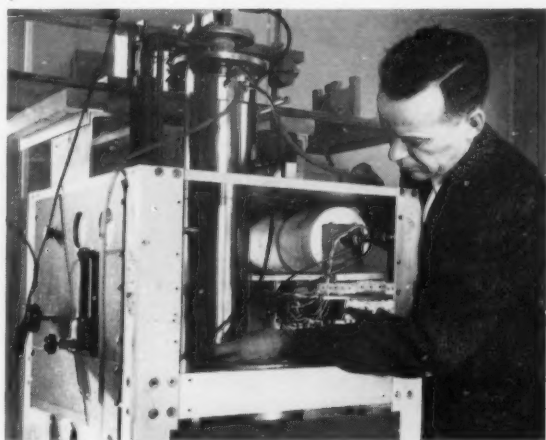
This prototype 120-foot diameter tropospheric scatter antenna, built by Blaw-Knox Co. was erected near Pittsburgh for trials. Antennas were designed for eastern and western extensions of the DEW Line.



Spincasting technique used by D. S. Kennedy & Co. produced near-optical quality on this four-foot antenna.



Scientists at Bell Telephone Laboratories designed this traveling-wave maser for satellite communication. It operates at a frequency of 2.4 Gc and is being used in



the Project Echo passive reflecting satellite experiment. Photo at left shows H. E. D. Scovil and R. W. DeGrasse. Above is D. C. Hogg; all are with Bell Telephone Labs.



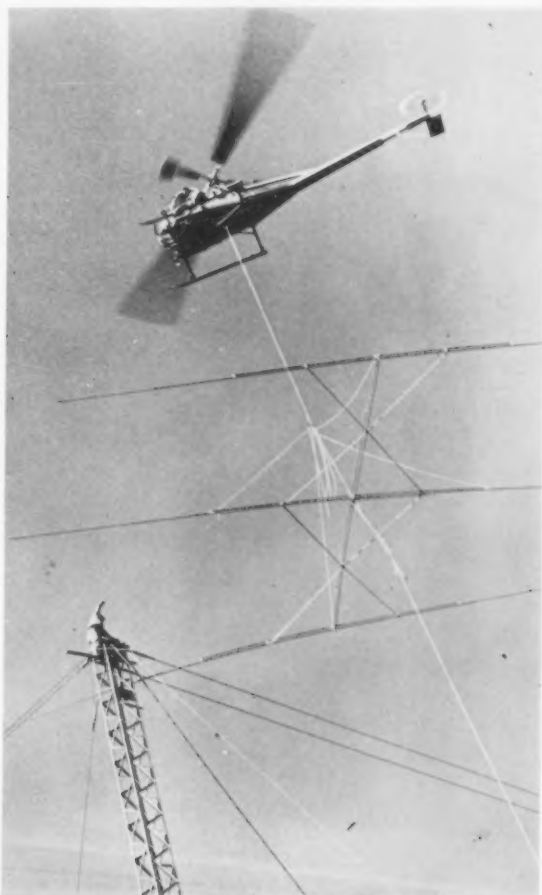
Stanford Research Institute and Stanford University, Palo Alto, Calif. use this upper-atmosphere radar to study auroral and meteor ionization, and moon echoes.



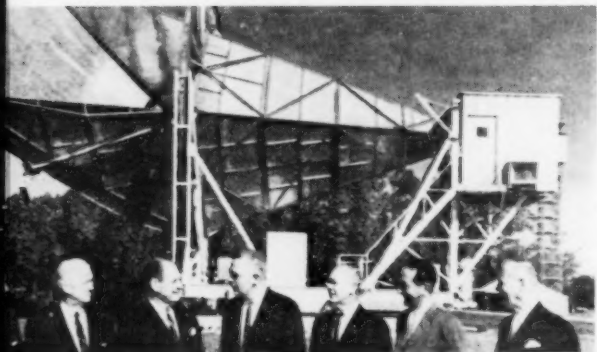
Thirty-two radio telescopes have been arranged in a Mills cross configuration at Stanford University to study the sun's surface. Beamwidth is 4 minutes of arc.



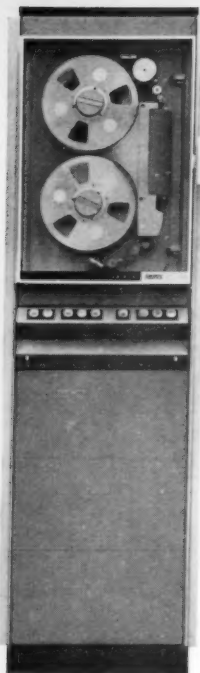
Low noise antenna used in Project Echo experiment is a section of a parabola. Its gain is 41 db at 5.65 Gc.



Hiller helicopter placed two antennas atop 112-foot towers at Stanford University in only 16 minutes flying time. Estimated cost was one-tenth of any other method.



This historic photo was transmitted by land line from Bell Telephone Labs. at Holmdel, N.J. to Stump Neck, Md., then bounced off Echo I satellite back to Holmdel.



The Ampex FR-700
wideband magnetic tape system
 can function as a universal
 predetection telemetry recorder.
 This ground-based companion to
 the airborne AR-300 both records
 and reproduces, and will play
 back tapes recorded on any Ampex
 AR-300. Bandwidth data is FM
 recorded using a 6 megacycle
 carrier. Rotating magnetic heads
 record transversely, one
 wideband channel for one hour at
 12½ ips., or two wideband
 channels simultaneously for one-half
 hour at 25 ips. Input power is
 1200 watts at 50 or 60 cycles. For
 specifications write to Ampex of
 Canada, Ltd., 607 Commonwealth
 Bldg., Ottawa, Ontario. **AMPEX**

For further information mark No. 13 on Readers' Service Card

CAMESA News

This bulletin has been prepared for CEE by the Specifications Division, Canadian Military Electronics Standards Agency, Ottawa.

► Military Standard **MIL-STD-202B**, covering test methods for electronic and electrical component parts, has received Canadian Services approval and is expected to be issued shortly. The following new test procedures are of particular interest:

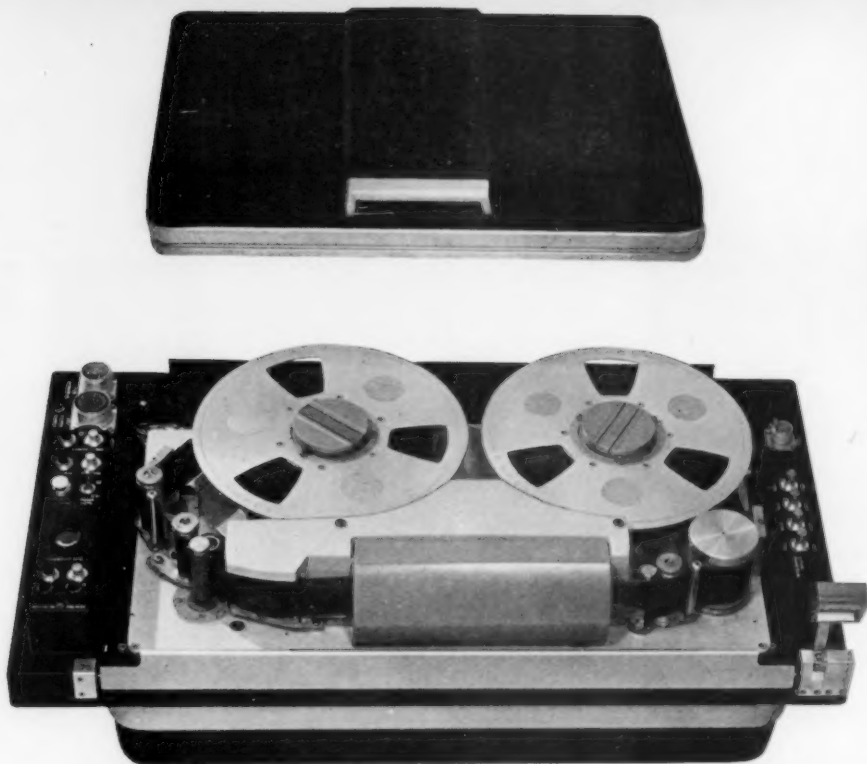
- (a) Method 108—Life (at elevated temperature). This method standardizes the many temperatures, tolerances and durations specified in individual specifications. It also defines the still air requirement of some resistor specifications.
- (b) Method 109—Explosion. This method is to determine whether a part will ignite an ambient explosive atmosphere while performing its normal function. The test is intended for parts which are not specifically designed to prevent explosion.
- (c) Method 110—Sand and Dust. This method is intended to determine the electrical and mechanical effects of a sand and dust laden atmosphere on a part.
- (d) Method 206—Life (Rotational). This method is provided to test parts operated by rotary action. Provision is made for the use of a slip clutch to prevent mechanical overload.
- (e) Method 207—High Impact Shock. This method utilizes the light weight shock-testing apparatus of specification MIL-S-901 (NAVY).
- (f) In addition to the above new methods, the following are revised:
 - Method 105B—Barometric Pressure.
 - Method 107A—Thermal Shock.
 - Method 204A—High Frequency Vibration.

► Canadian Specification Sheets **CSS-80A, -81A, -83A and -85A**, covering radio frequency connectors series "C", "HN", "N" and "QDS" respectively, have recently been issued. The connectors covered are approved by the Canadian Armed Forces, but are not listed in the applicable basic specifications.

► Specification **MIL-C-11693B**, covering radio interference reduction capacitors of the feed-through type has recently been issued. The scope of the specification now covers additional dielectric materials such as paper, plastic, metallized paper and metallized plastic. Fourteen new detail specifications, covering 15 capacitor styles, have been added. Three of the new styles are in the 150 deg. C. class.

Want to know more about IRE?


Will Copp and Herb White at Booth 30 will be glad to tell you all about membership, publications, meetings, emblems, pins, etc.



The Ampex AR-300 airborne magnetic tape recorder

offers 16 times the frequency response of existing wideband equipment.

New applications in video bandwidth recording such as radar tracking and reconnaissance, simulation and wideband communications monitoring, are now practical because the AR-300 — and its ground-based companion, the FR-700 — employs rotating magnetic heads... a principle pioneered by Ampex and now in use by more than 650 VIDEOTAPE*

Television Recorders throughout the world. Two channels of wideband information can be captured over a data spectrum from 10 cps to four megacycles, ± 3 db. Simultaneously, two auxiliary information channels, with frequency response from 200 cps to 15 Kc, are recorded linearly along the edge of the tape. Solid-state components and advanced packaging techniques case-shock mounted provide a recording system that displaces only $3\frac{1}{2}$ cu. ft., weighs less than 150 lbs. To obtain a highly accurate time-base relationship, tape is pre-heated prior to recording. A heat exchanger maintains constant ambient, insuring reliable operation of the AR-300 under extreme environmental conditions. For specifications write to Ampex of Canada, Ltd., 607 Commonwealth Bldg., Ottawa, Ontario. 

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For further information mark No. 22

Reports—continued

Canadian Electrical Supply Co. Ltd., Montreal, Quebec, Ottawa, and Toronto has been appointed Texas Instruments Semiconductor-Components distributor in Canada.

The Shockley Transistor Unit of Clevite Transistor, Palo Alto, Calif., has named **Adams Engineering Ltd.**, Montreal and Toronto, as engineering sales rep. in Eastern Canada (advanced semiconductor products, including the Shockley 4-layer diode).

R-O-R Associates Ltd., Don Mills, Ont. and Montreal, are now Canadian sales rep. for the Instrumentation Division of Baldwin-Lima-Hamilton Corp., Waltham, Mass. (complete instrumentation service).

Carriere and MacFeeters to make Guardian line

Guardian Electric Mfg. Co. of Chicago has entered into a manufacturing agreement with Carriere and MacFeeters Ltd. of Scarborough, Ont. The Canadian firm's manufacturing division will produce Guardian-designed aircraft, missile and military controls, relays, solenoids, steppers, switches, contactors, and commercial controls.

Sales and distribution of both Guardian and Carriere and MacFeeters products will be made through A. C. Simmonds & Sons Ltd., Toronto.

Lorain establishes Canadian company

Lorain Products Corp., Ohio, manufacturers of SUB-CYCLE ringing convectors, FLOTROL battery chargers and power supply units for the telephone industry, have established manufacturing facilities in Canada.

The Canadian company, Lorain Products (Canada) Ltd., is located at St. Thomas, Ont. General manager is

J. A. McVeigh, formerly manager of the Canadian Allis-Chalmers works at St. Thomas; sales manager is G. I. Phillips, formerly sales engineer for Redmond Motors, St. Thomas.

Lorain products are distributed in Canada by Automatic Electric Sales (Canada) Ltd., and for the Bell Telephone Co. of Canada by Northern Electric Co. Ltd.



McVeigh



Phillips

Erie Resistor closes Toronto sales office

G. Fred Eaton Jr., sales manager of Erie Resistor of Canada Ltd., has resigned from the company. Engineering and sales service will continue by the use of Erie's direct Toronto telephone line to the Trenton factory, EMpire 2-3315. Geo. F. Kempf, vice-president and general manager, has announced that plans for servicing customers through a Toronto sales office are being studied.

Helipot adds sales department to manufacturing facility

Formerly handled by R-O-R Associates Ltd., Don Mills, Ont. and Montreal, Canadian sales activities of Helipot Division, Beckman Instruments Inc. are now to be in charge of George Williams of Helipot. Previously production manager of the Toronto firm, Mr. Williams becomes district sales manager effective October 15.

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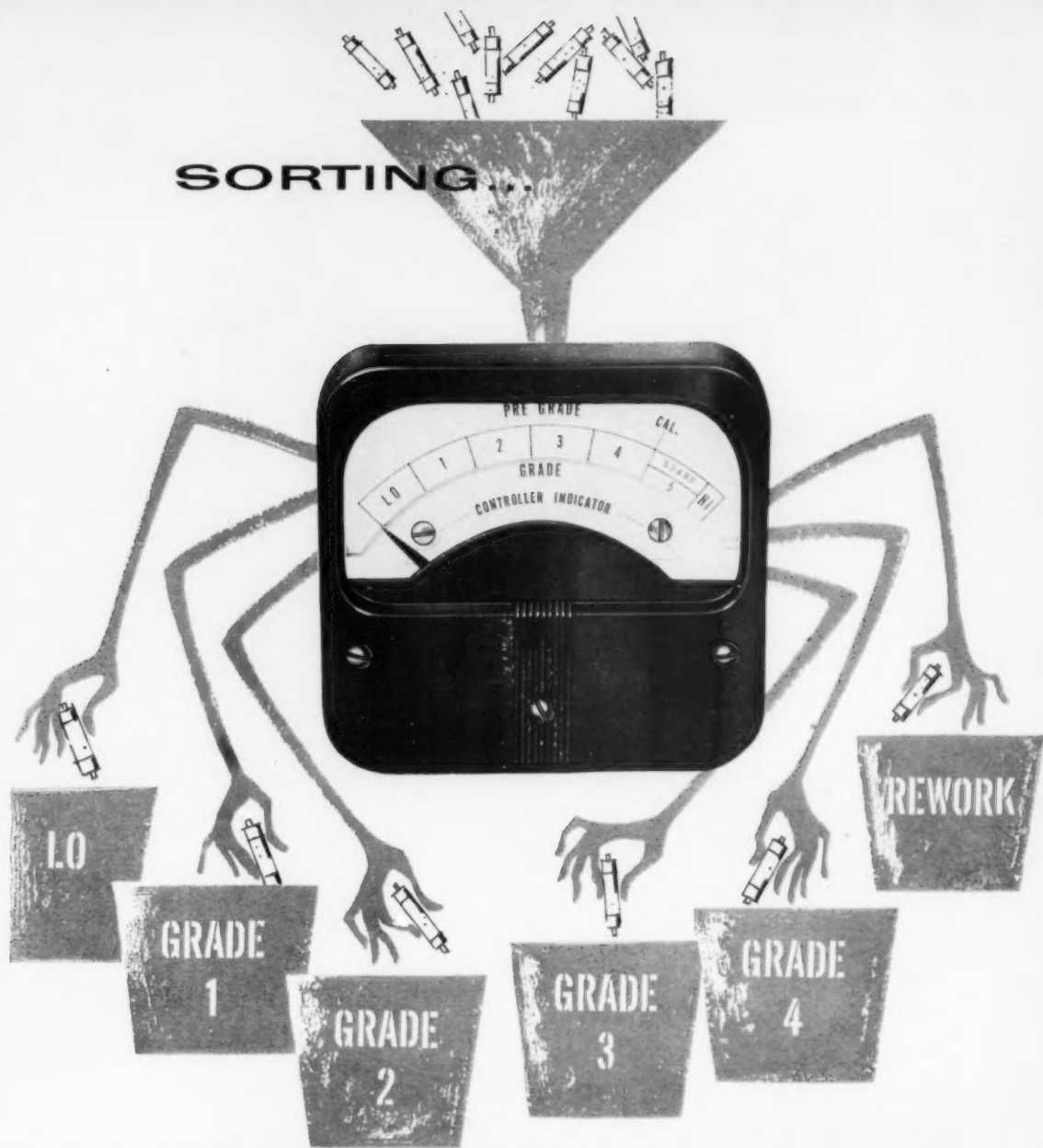
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CANADIAN ELECTRONICS ENGINEERING OCTOBER 1960



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Semiconductor handbook provides data for design engineers

Selected Semiconductor Circuits Handbook

Edited by Seymour Schwartz; John Wiley & Sons, Inc., New York; 503 pp.; \$12.00.

Reviewed by M. A. Gullen, assistant professor, School of Engineering, Carleton University, Ottawa.

The book is a parallel to previous works by Markus and Vin Zeluff, Markus alone, and Matthew Mandl covering specialized tube circuitry but, within the semiconductor circuit field, is much wider in its scope. The greater part of the material was published, originally, by the U. S. Bureau of Ships as "A Handbook of Selected Semiconductor Circuits" for Armed Services designers.

The book is divided into 11 parts. Part I briefly describes the construction of the parts to follow and summarizes their contents. Basic "building-block" circuit units are treated, individually, thereafter under such headings as Direct-coupled, Low-frequency and High-frequency Amplifiers, Oscillators, Switching and Logic Circuits, AC to DC Power Supplies and Power Converters, Non-linear Circuits, (modulators, mixers and detectors, etc.), and Transistor Circuits containing magnetic core elements. Each part is subdivided into two sections. The first, under the heading of Design Philosophy, contains a nutshell treatment of the basic theory appropriate to the part and summarizes the present state of the art. It is completed by an extensive and up-to-date bibliography. The second, under the heading of Selected Circuits, contains, on the average, some 12 representative schematics, each with brief notes on special circuit features. Semiconductor type numbers and all component values are included in each schematic.

The book should find a place on the desk of the graduate student and the working circuit design engineer, both as a well-constructed reference for summary reviews of circuit theory and as a convenient and useful starting point for more highly detailed work within specialized areas. Its authority may be assessed from the calibre of its contributors among whom the names of S. K. Ghandi, H. C. Lin, P. G. Sulzer and J. J. Suran may be noted. Such a book might be expected to have a relatively short useful lifetime but, here, the treatment of basic design theory is sufficiently comprehen-

sive to provide material of lasting value.

Microwave data tables

A. E. Booth; British Book Service (Canada) Ltd., Toronto; \$6.50.

Reviewed by W. J. Muller, chief engineer, Airtron Canada Ltd., Toronto.

This book is intended as a reference for use in design offices and laboratories. To aid in the use and understanding of the tables a section at the beginning of the book gives the mathematical formulae used in computing the data tables. There are 26 data tables in all featuring:

1. Decibels gain and loss to power ratio.
2. VSWR to power reflection coefficient.
3. VSWR to transmission loss by reflection.
4. Frequency to free space wave length.
5. Frequency to guide wave length for all standard waveguide sizes.
6. Conversion tables of centimetres to inches.

British nomenclature is used for waveguide sizes, but fortunately, British waveguide sizes are identical with U. S. standards. The data tables have been computed to limits of good measuring accuracy, that is, three-place decimals on VSWR at frequency and two places on decibel values. In all, the author has compiled a practical set of data tables of great use to engineers and technicians employed in the microwave field.

Publishers' new releases

Abstracts

Cambridge Communications Corp., 238 Main St., Cambridge 42, Mass. is offering abstracts (journal and index card form) in the areas of solid state devices and computers. Full information and rates may be obtained by writing to the Corporation.

Research Information Service Translations

A large number of recent patent applications by leading German manufacturers dealing with computer and control elements, semiconductors, ferrites, and miscellaneous equipment; as well as recent Russian research papers in the same fields are now available in English translation from Research Information

Service, a Division of Pergamon International Corp., 40 East 23 St., New York 10, N.Y.

Introduction to the Cathode Ray Oscilloscope

This short, clear account of the basic principles of the cathode ray oscilloscope, written by Harley Carter M.I.E.E., demands only elementary electrical knowledge and draws examples from a wide range of applications. Cleaver-Hume Press Ltd., 31 Wright's Lane, Kensington, London W8; about \$2.00.

Airpax Technical Journal

This is a series of technical articles on equipment manufactured by Airpax Electronics, Inc. Vol. 1, No. 2 provides a Review of the Transistor Chopper. For copies, write to Airpax Electronics Inc., Cambridge Div., Cambridge, Maryland.

Electronic Equipment Used in the Nuclear Energy Industry in France

This book, written in French with summaries in English, Russian and Spanish, is a review of nuclear electronics in applications which have developed through the advance of nuclear energy. Copies may be ordered from International Atomic Energy Agency, Lothringerstrasse 18, Vienna, Austria. Price: \$1.00 U.S. currency.

Self-Organizing Systems

This volume comprises the Proceedings of the Interdisciplinary Conference on Self-Organising Systems sponsored by the U. S. Office of Naval Research and Armour Research Foundation, May, 1959. It includes papers and discussions presented by research workers in a number of scientific disciplines concerned with the general problem of self-organization. These disciplines included Embryology, Engineering, Mathematics, Neurophysiology and Psychology. Pergamon Press, Inc., 122 East 55 Street, New York 22, N.Y.; 454 pages; \$8.50.

Inertial Guidance

Written by C. S. Draper, W. Wrigley and J. Hovorka of Massachusetts Institute of Technology, this is a descriptive treatise on the physical principles and engineering methods underlying the navigation and control of vehicles solely by means of signals from sensors that depend only on the inertial properties of matter for their operation. Pergamon Press, Inc., 122 East 55 Street, New York 22, N.Y.; 190 pages; \$6.50.

Agard Eight-Language Aeronautical Dictionary

Compiled under the control of the Documentation Panel of Advisory Group for Aeronautical Research and Development of the North Atlantic Treaty Organization. The dictionary comprises some 2000 terms and their definitions, in eight languages, English, French, German, Spanish, Italian, Dutch, Turkish and Russian. It was prepared with the cooperation of specialists in each participating country. Pergamon Press, Inc., 122 East 55 Street, New York 22, N.Y.; 300 pages; \$20.00.

Instrument Society of America elects new officers

Members of the Instrument Society of America at their 15th annual meeting in New York City, Sept 27, elected the following officers for the year 1960-61.

Assuming presidency of the Society, after serving a year as President-elect-Secretary, was Dr. Ralph H. Tripp, Huntington, L. I., assistant director, Flight Test Division, Grumman Aircraft Engineering Corp., Bethpage, L. I., with which company he has been associated for the last 18 years.

Chosen President-elect-Secretary, which moves him into position for the post of president 1961-62, was Philip A. Sprague, president of The Hays Corporation, Michigan City, Ind.

John C. Koch, Ft. Washington, Pa., executive vice-president of Conoflow Corporation, Philadelphia, Pa., was elected Treasurer of ISA. He has been filling this position since 1959 on an unexpired term.

Elected vice-president ISA's Technical Department, was Henry J. Noebels, Santa Ana, Calif., manager of applications engineering, Beckman Instruments, Inc., Fullerton, Calif.

E. Albert Adler, Springfield, Pa., chief instrumentation engineer, United Engineers & Constructors, Inc., Philadelphia, was elected vice-president, Standards & Practices Department.

Named as vice-president-elect, Industries Department, was John J. McDonald, vice-president and director of engineering, Consolidated Systems Corp., Monrovia, Calif.

Francis R. Hoag, Brecksville, Ohio, was named vice-president-elect of the Society's Education & Publications Department. He is an instrument engineer at the B. F. Goodrich Research Centre, Brecksville.

Five District Vice-presidents also were elected. They are:

District II, H. Kirk Fallin, Towson, Md., combustion engineer, Bethlehem Steel's Sparrows Point (Md.) Plant; District IV, Fred R. Gilmer, Charleston, W. Va., division engineer, E. I. du Pont de Nemours & Co., Inc., plant, Belle, W. Va.; District VI, Otto J. Lessa, Wayne, Ill., assistant district manager, Hagan Chemicals & Controls, Inc., Lombard, Ill.; District VIII, Roy Horton, president of Research Controls, Inc., Tulsa, Okla.; District X (Canada), Kenneth S. Vriesen, Clarkson, Ontario, general manager, DeVry Tech-

nical Institute of Canada, Toronto.

J. Rogers, chief engineer, The Bristol Co. of Canada Ltd., Toronto, has been named general chairman of the ISA Summer Instrumentation conference and exhibit to be held in Toronto June 5-8, 1961. Mr. Rogers served as vice-president of District X (Canada) for the year 1959-60.

Service group names Canadian executives

The National Industrial Service Association, Inc. has appointed H. C. Blenkhorn, president, Blenkhorn & Sawle, Ltd., St. Catharines, Ont., chairman of the By-Laws and Resolutions Committee. R. Sawle, vice-president of the St. Catharines' firm, has been named to the association's Engineers' Advisory Committee.

A. G. Bamford, general manager, Sutherland-Shultz Electric Co. Ltd., Kitchener, Ont., has been appointed chairman of the Canadian Affairs and the Management committees.

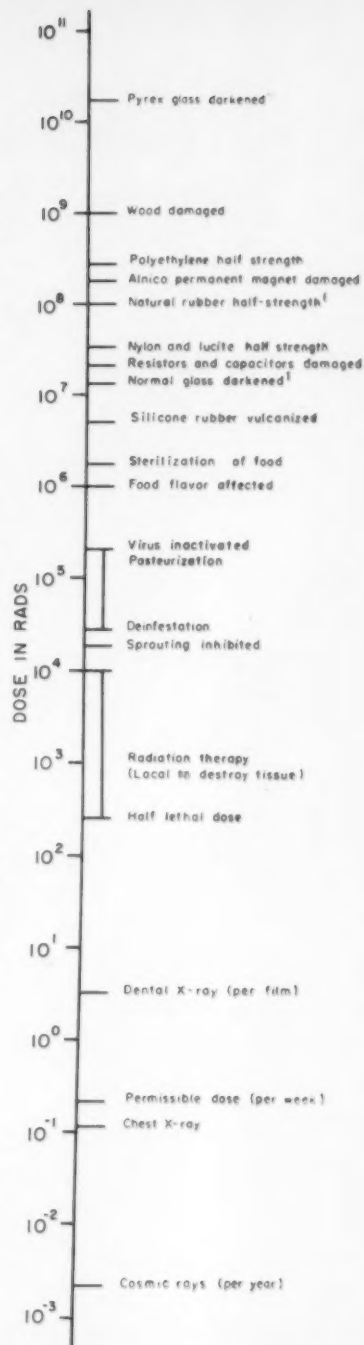
NISA is an international trade organization of more than 1500 electrical apparatus service and sales companies in North America. The name of the association changes officially April 1, 1961, to Electrical Apparatus Service Association, Inc.

Mr. Blenkhorn served as international president in 1959-60, and is still a member of the board of directors and executive committee.

100 Mev Linac will permit new research

New areas of research are expected to be possible with a 100 Mev, 40 kw microwave linear electron accelerator (Linac) to be built for the National Bureau of Standards, Washington, D.C. The machine, designed by High Voltage Engineering Corp., Burlington, Mass., will utilize a new technique in acceleration waveguide design known as the High-Q formula. Waveguides incorporating this design employ resonant structures which can handle large peak beam currents and pulse lengths, and provide more efficient conversion of microwave power to electron-beam powers.

The Linac will serve as an experimental tool in research programs in low temperature chemistry, solid state physics, metallurgical studies, activation analysis for trace elements, nuclear alignment studies and property determination of irradiated materials.



Average dose produced by proposed NBS 100 Mev accelerator extends up to 10¹⁰ Rads. The effects which could thus be produced include such important processes as polymerization, food sterilization and pasteurization.

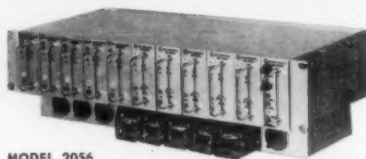
It will be installed at Gaithersburg, Md., 20 miles northwest of Washington.

(Continued on page 84)

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Microwave Systems

46 Crockford Blvd., Scarborough, Ont.
Tel. Toronto PL. 5-0763

Controls — cont.

Weltronic opens Canadian plant

Manufacturing, sales and service facilities for resistance welding and other industrial controls have been established by Weltronic Co., Canadian Division at 3201 Marentette Avenue — Sub. No. 5, Windsor, Ontario. Telephone: Clearwater 2-2701. General manager of the Canadian Div. is Eugene Smith.

ISA continues U.S.S.R. translation service

Publication of four Russian technical journals, translated into English, will be continued with the 1960 issues during the coming year by the Instrument Society of America, under a grant from the National Science Foundation. Included in the series are: Automation and remote control; Measurement techniques; Instruments and experimental techniques; and Industrial laboratory.

For subscriptions or information write to Foreign Translations Dept., Instrument Society of America, 313 Sixth Avenue, Pittsburgh 22, Pa.

Plutonium-in-air monitor

The Atomic Weapons Research Establishment, Aldermaston, England, has developed a monitor capable of giving rapid warning in the event plutonium is released into the atmosphere. It continuously samples air for plutonium alpha activity.

The plutonium dust particles are impacted on to a zinc sulphide coated film that is measured continuously with an alpha scintillation counter. The impactor collects particles of about 1 micron in size, such as those of plutonium, more readily than it does smaller particles like those of radon or thoron decay products, which are swept through.

Sampling is carried out for pre-set periods and alarm signals are generated whenever the count exceeds a pre-set number.

Going to the IRE Communications Symposium, Montreal, Nov. 4-5? Use the advance registration and hotel reservation cards on page 105 to save time and money.

New products at the show

Wideband recording system 103

Developed for military and scientific applications, this new wideband recording system is incorporated in two models, one airborne, the other a ground unit.

The airborne unit, AR-300 is a miniaturized recorder (no playback) which provides two channels capable of recording data over the frequency range of 10 cps to 4 Mc, ± 3 db. In addition, it provides two auxiliary recording channels with frequency response from 200 cps to 15 kc.

The AR-200 uses the same type of rotating heads as are used in Videotape television recoders. Four heads for each channel are mounted around the periphery of a drum, which rotates as the tape goes past it. Effective tape-to-head speed of 1300 ips is accomplished with lateral tape speeds of 12½ or 25 ips. Data is recorded using frequency modulation of a 6 Mc carrier.



The companion ground unit, FR-700 (illustrated), provides both recording and reproducing functions. Its characteristics are similar to the airborne unit. Ampex of Canada Ltd. Booth 1

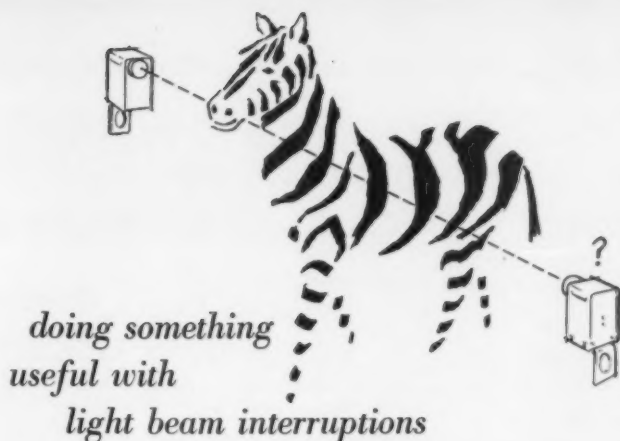
Frequency selective voltmeter 104

Sierra Electronic Corp. frequency selective voltmeter model 125A is a tunable voltmeter operating over a range of 3000 cps to 600 kc, and a broadband ac VTVM that is flat (± 0.2 db) between 1 kc and 600 kc. Crystal lattices provide steep-skirted IF bandwidths of either 250 cps for analyzing complex waves, or 2.5 kc for general carrier system measurements. As a VTVM, measurement accuracy is better than ± 0.5 db for all signal levels within the capacity of the instrument.

Designed for use with either 600 or 135 ohm transmission lines, the bridging loss introduced by the model 125A is less than 0.25 db throughout its useful range.

Atlas Instrument Corp. Ltd. Booth 11

(Continued on page 86)



Our affiliate, The Fisher-Pierce Co., is in the photoelectric control business and began fooling around with CdS photocells as a replacement for phototubes some 6 or 7 years ago. We in turn are pretty well into the electromagnetic relay business, and have been tweaking springs and whiffing magnets for about 20 years. It shouldn't surprise a soul then to learn that we have a new line of photorelays, consisting very simply of the respective products living inside a little can. This is a new "line", which gives you a choice in the type of cell, relay contact arrangement, packaging and operation under on-off, slowly changing or high ambient light conditions. The 8RC01A, for example, has a CdS cell, responds to "light—no light" conditions, switches 3 amp. 120 VAC resistive loads with SPDT contacts, and has an aluminum dust cover with plug-in base. If your machinery or control circuit is already built, you might be more interested in the complete "package deal" consisting of both photorelay receiver and light source, whose application requires bolting the units onto something and plugging in the line cord.

There are all sorts of things these photorelays can do for you, coupled with a small amount of ingenuity and 120 volts. They can act as the brains to prevent a

process or machine from grinding on if the feed is empty or the operator's hands are in the way; look at the level in a bin or column, or "measure" the level between set points; turn on inside lights in response to a night watchman's flashlight; switch display or sign lighting on at dusk, off at midnight, on again from 6 A. M. to dawn, in conjunction with a time switch (this is the sort of thing in which Fisher-Pierce shines); and all the familiar counting, door-opening and 60-second hand-drying applications.

If you're interested in more exotic uses and have any hot nonincandescent bodies lying around, we can build you a special model with a cadmium selenide cell responsive to infrared rays (sources of infrared we cannot supply at the moment). Other non-standard possibilities include hermetically sealed units, special contact materials and units with low or high foot-candle turn-on points.

Be not faint of heart if your application lies beyond the commonplace. One man of vision found success and happiness by using a Sigma Photorelay in his Chinese fortune cookie machine... with a little luck, you might be able to open a new frontier in light-beam-actuated swiss cheese manufacture. Bulletin with guiding specs on request.



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Sigma Booth #47, I.R.E. Symposium on Communications Nov. 4 and 5, 1960, Queen Elizabeth Hotel, Montreal. Distributed by: Wholesale Radio & Electronics Ltd., Toronto, Ontario.

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Religion PRENTICE-HALL Science & Engineering books

ENCYCLOPEDIA DICTIONARY OF Electronics and Nuclear Engineering

SARBACHER. Giant fingertip guide: scientific terms, elements, components, systems, potentials. Groups for quick comparison what's new, what's available. Standard definitions of ALL technical societies. Armed Forces terms. Compact explanations. 1417 pages. 1435 drawings. 17,000 cross-references. 1,000,000 words. Praised by top men, journals. 1959. \$35.



Computer Logic — FLORES

First book of its kind to present a complete block diagram analysis of each operational unit of a digital computer. Describes fully just how a computer is put together, how it works. Shows way control unit supervises performance of majority of commands in repertoire of average computer. Logic for all processes of arithmetic, input/output equipment. Mechanical details. Fully illustrated. Standard symbols. 480 pages. 1960. \$12.

Handbook of Laplace Transformation — NIXON

Most extensive tables of Laplace Transform Pairs available, number-coded for easy selection. Shows detailed examples of practical physical problems with step-by-step solutions by Laplace Transform method. Complete explanation of use of determinants, with examples. Extensive tabulation of useful mathematical equations, series relationships. Discussion and derivation of important theorems. 128 pages. 1960. \$6.

Theory and Application of Ferrites — SOOHOO

Treats ferrite behavior at radio and microwave frequencies as a unified, single subject, not as unrelated topics. Only materials tested experimentally included, many original with author. Gives the practicing engineer and physicist both a general and specific knowledge of ferrite behavior. Applicable problems facilitate comprehension. Author on Research Staff, Lincoln Laboratory, M.I.T. 288 pages. 1960. \$12.

See our Exhibit at the Convention - Booth 37

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SAVE! If payment is with order, books will be sent prepaid. Refund on books returned within ten days. On billed orders a few cents is charged for packing and postage.

New products at the show

Compression amplifier 105

Central Dynamics compression amplifier type CAA 1011 has an input impedance of 50 ohms nominal balanced, and an output impedance of 600 ohms nominal balanced. Uncompressed gain is 65 db and compression starts at an input level of 60 dbm. Output changes 1 db for 3.5 db change of input level. Frequency response is ± 3 db between 100 cps and 5 kc.

Aeromotive Engr. Prods. Ltd. Booth 15

Light-route radio 106

Lenkurt Electric light-route radio type 71 will provide economical installation for up to 24 multiplex voice channels over distances of up to 500 miles, or ten repeater links. Greater channel capacity can, where required, be provided over shorter distances. Type 71 is a family of FM radio and associated equipment, the first available being 71A-450 operating in the frequency



range 450 to 470 Mc. Although specifically designed to provide toll grade service, the type 71 radio is a system which has a variety of light-route applications. Automatic Electric Sales (Canada) Ltd. Booth 4

Controller-indicator system 107

In the Controller-Indicator system, a carefully integrated group of components combines the versatility, sensitivity and accuracy of the panel meter with the ability to exercise supervisory control automatically. Any quantity normally capable of presentation on a switchboard type panel instrument, can be indicated on a Controller-Indicator instrument. The same instrument will deliver control signals so as to establish or maintain operating conditions in a specific relation to the indicated quantity.

The Controller-Indicator system also encompasses a range of motor driven measuring bridges, and motor driven switches and programmers.

Bach-Simpson Ltd. Booth 29

For further information mark No. 76 on Readers' Service Card

Insertion loss scanner

108

Insertion loss scanner model PTC 1206 has been designed to measure characteristics of coaxial cable systems and submarine cables, and for testing frequency translating equipment (single group and supergroup) and similar applications. The overall scanning bandwidth provided is 50 Kc-8 Mc with facilities for narrower band operation of 0-2 Mc or 0-4.5 Mc.

The equipment can be used for uni-directional or loop tests and in addition to measuring system losses, bandwidth characteristics, etc., it can be used as a return loss bridge. Two sweep rates are provided, 25 sweeps per sec. for the CRT, and a forward rate of approximately one sweep per minute for recording.

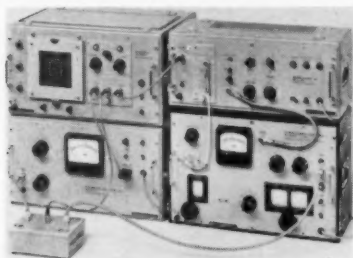
Pye Canada Ltd.

Booth 40

Wobble frequency test setup

109

Wandel and Goltermann wobble frequency test setup model WM-1 is an FM automatic display setup utilizing standard wideband voltmeter, carrier signal generator, oscilloscope and wobble generator, all of which are usable separately. The whole arrangement has the accuracy of the individual test sets employed, so that results are as accurate



as point-by-point plotting. Any desired center frequency between 10 kc and 14 Mc is obtained from the signal generator. The display X-axis can be adjusted to as fine a resolution as 4 kc anywhere in the 14 Mc range. In the Y-axis, a resolution of up to 0.02 db is possible.

R-O-R Associates Ltd.

Booth 21

Hot-cold body standard

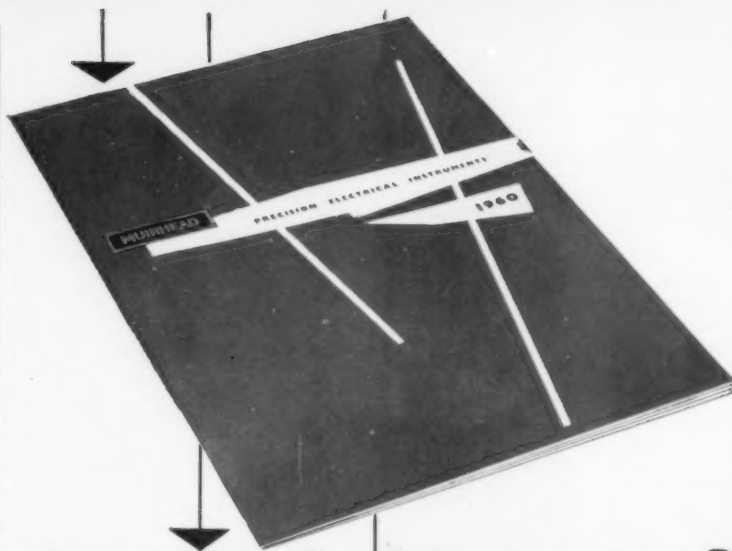
110

Airborne Instruments Lab. type 70 hot-cold body standard noise generator provides a means of accurately measuring low noise figures over a frequency range of 0 to 2 Gc. It uses two resistive elements, one immersed in liquid nitrogen (77.3 K) and the other in a temperature-controlled oven (373.1 K). Operation depends on the fact that thermal agitation of electrons in any pure resistance develops a noise voltage. The amount of noise power supplied by the AIL type 70, when matched to a conjugate load, is equal to KT_B , where K is Boltzmann's constant, T is the temperature in degrees Kelvin, and B is the bandwidth.

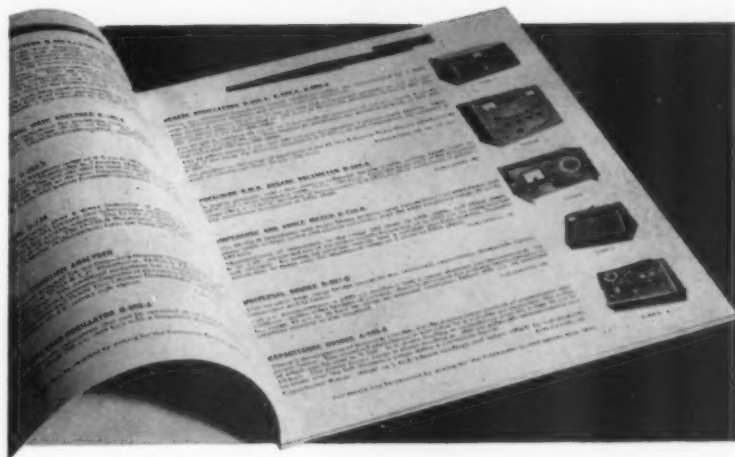
Radionics Ltd.

Booth 17

(Continued on page 89)



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The new MUIRHEAD abridged catalogue briefly describes the latest instruments in production and quotes the reference numbers of the publications which more fully describe individual types.

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Defence contracts

Unclassified electronics contracts for \$10,000 or more have been awarded to the following Canadian firms by the Department of Defence Production. A figure in parentheses indicates the number of contracts the amount being the total value.

August 1-15, 1960

- ▶ Ampex of Canada Ltd., Ottawa, amplifiers, \$10,130.
- ▶ Bureau of Industrial Electronics of the Province of Quebec, Montreal, investigations and analytical services per-

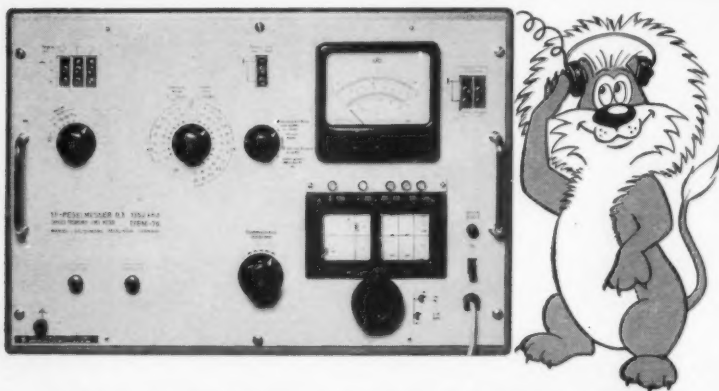
taining to navigation and other military systems, \$20,000.

- ▶ Canada Wire and Cable Co. Ltd., Ottawa, telephone cable (buried), \$306,611.
- ▶ Canadian General Electric Co. Ltd., Toronto, aircraft instruments, \$10,206.
- ▶ Canadian Marconi Co., Montreal, components, \$22,417.
- ▶ Canadian National Telegraphs, Ottawa, rental of teletype facilities, \$17,338.
- ▶ Collins Radio Co. of Canada Ltd., Toronto, range indicators, \$64,607; antenna, \$14,843.
- ▶ Mechtron Engineering Products Ltd., Ottawa, mobile public address systems, \$12,480.

- ▶ Northern Electric Co. Ltd., Belleville, Ont., revision sheets for technical publications, \$195,021.
- ▶ Northern Electric Co. Ltd., Ottawa, equipment, \$12,607.
- ▶ Powerlite Devices Ltd., Montreal, equipment, \$153,584.
- ▶ Ray-O-Vac (Canada) Ltd., Winnipeg, batteries, \$120,934.
- ▶ Raytheon Canada Ltd., Ottawa, tubes, \$89,216.
- ▶ Sperry Gyroscope Co. of Canada Ltd., Montreal, models control equipment, \$620,791.

Contract awarded by Defence Construction (1951) Ltd.

- ▶ Avro Aircraft Ltd., Toronto, supply and installation of electronic controls for high speed wind tunnel at Uplands Airport, Ottawa, \$71,580.



SELECTIVE VOLTMETER with AUTOMATIC TUNING

Model TFPM 76 carrier frequency selective level meter acts as a wide-band voltmeter from 300 cycles to 1.35 MC and as a selective voltmeter from 2000 cycles to 1.35 MC. Full scale deflection sensitivity 25 microvolts (-90 to +20 DBM) on selective tuning. Selective bandwidth is ± 170 cycles, down -60 DB ± 500 cycles from tuned frequency, permitting measurements on operating carriers or in gaps between channels. Used with mating signal generator TFPS75, the voltmeter tunes automatically to the generator frequency. This permits measurements on lines, networks, filters, amplifiers, etc., free of interference and noise, with sensitivity to minus 120 DBM.

In addition to voltage and power (DBM), these instruments measure impedance values, mismatch DB, balance and complex resistance.

Other features include:

- built-in precision calibration source
- use as wideband or selective amplifier
- 1 kc tone on output for phones
- input resistances 75, 150, 600 ohms, and high Z
- balanced or unbalanced input
- D.C. output for graphic recorders

Manufactured by Wandel & Goltermann, Reutlingen, West Germany.

These instruments are now available at R-O-R for trial and demonstration.



R-O-R ASSOCIATES LIMITED
1470 DON MILLS RD., DON MILLS, ONT.

For further information mark No. 80 on Readers' Service Card

August 16-31, 1960

- ▶ Ampex of Canada Ltd., Ottawa, airborne multichannel magnetic tape recording facility, \$15,096.
- ▶ Avlon Telephone Co., St. John's, Nfld., supply and installation of telephone cable extension, \$13,912.
- ▶ B.C. Telephone Co., Vancouver, rehabilitation of outside telephone cable plant, \$27,308.
- ▶ Canadian Aviation Electronics Ltd., Winnipeg, installation and testing of microwave equipment, \$15,617.
- ▶ Canadian Marconi Co., Montreal, airborne navigation equipment, \$1,184,019 (4); magnetrons, \$145,590.
- ▶ Collins Radio Co. of Canada Ltd., Toronto, equipment, \$17,389.
- ▶ Consolidated Electronic Equipment Co. Ltd., Willowdale, Ont., equipment, \$12,630.
- ▶ Cowley Electronic Services Ltd., Edmonton, antenna system for transmitting site, \$46,330.
- ▶ Delta Aircraft Equipment Ltd. Toronto, antennas, \$18,666.
- ▶ E.M.I.-Cossor Electronics Ltd., Dartmouth, N.S., antenna system, \$74,944.
- ▶ Fleet Manufacturing Ltd., Fort Erie, Ont., sonar domes, \$118,966 (2).
- ▶ Instronics Ltd., Stittsville, Ont., spectrum analyzers, \$35,390.
- ▶ Marsland Engineering Ltd., Kitchener, Ont., explosive echo ranging equipment, \$365,465 (2).
- ▶ Measurement Engineering Ltd., Arnprior, Ont., signal generators, \$15,004.
- ▶ Northern Electric Co. Ltd., Ottawa, maintenance spares for teletype equipment, \$25,020.
- ▶ Northern Radio Mfg. Co. Ltd., Ottawa, voice frequency carrier telegraph terminal equipment, \$114,044.
- ▶ Philco Corp. of Canada Ltd., Don Mills, Ont., technical representatives, \$52,964.
- ▶ RCA Victor Co. Ltd., Montreal, maintenance of microwave and multiplex equipment, \$232,168; engineering consultant services, \$21,126; equipment, \$35,425.
- ▶ Radionics Ltd., Montreal, oscilloscope recording camera systems and assemblies, \$124,755.
- ▶ TMC (Canada) Ltd., Ottawa, transmitters, \$21,604.

JERROLD

R. F. Test Equipment

Quantitative Measurements Using Sweep Frequency Techniques



Model 900A—THE MOST VERSATILE SWEEP GENERATOR

CENTER FREQUENCY—VHF 0.5 to 400 MC
UHF 275 to 1000 MCS—SWEEP WIDTH—
up to 400 MCS—FLATNESS— ± 0.5 db over
widest sweep



Model 707—ULTRA FLAT SWEEP GENERATOR

Featuring $\pm 5/100$ db flatness—Plug-in osc. heads*, variable sweep rates from 1/min. to 60/sec.; all electronic sweep fundamental frequencies; sweep width min. of 1% to 120% of C.F.

*Heads available within the spectrum 2 to 265 MCS

Models 601/602—PORTABLE GENERAL PURPOSE \$295.00

COVERAGE—Model 601—12 to 220 MCS. Model 602—4 to 112 MCS—FLATNESS— ± 0.5 db OUTPUT—up to 2.5 V RMS WIDTH—1% to 120% of C.F.



Model FD-30

High speed DPDT coaxial switch permitting oscilloscope measurements without calibration—all measurements referenced continuously against standard attenuators.



Model AV-50 Variable Precision Attenuator

Long life rotary switches; dual wiping silver contacts on "Kel-F" dielectric. 0-62.5 db in $\frac{1}{2}$ db steps; DC to 500 MCS.

Write for catalog and technical Newsletter series on measurements using sweep frequency techniques. Prices and data subject to change without notice.

JERROLD ELECTRONICS (Canada) Ltd.
50 Wingold Avenue, Toronto 19
Jerrold Electronics Corporation, Industrial Products Division, Dept. ITE-30, The Jerrold Building, Philadelphia 32, Pa.

New products at the show

High temperature coaxial cable 111

Low loss silica mineral insulation is employed within stainless clad copper in Technicraft low loss transmission lines. This RF coaxial cable provides low losses in ambients up to 1000 F continuously. For shorter periods, applications to 1700 F are possible. Semi-flexible designs are available from 0.144 in. OD to 0.375 in. OD.

Microwave Systems

Booth 43

Rotary stepping switch 112

Series 9C Cycloswitch is designed to provide true digital behaviour up to 240 steps or 12 revolutions per second. It consists of a high speed stepping motor and printed circuit switch decks. In operation it will stop instantly at any predetermined position on the switch deck.



The flush printed switch decks are available in various combinations to meet specific needs. Brush arrangements can be common to 10-ring, to 20-ring or both on one or two decks.

Sigma Instruments, Inc.

Booth 47

Microphone cables 113

Tinned cadmium bronze conductors have been used for extra flexibility in Belden microphone cables. Type 8413 is a miniature, 2-conductor, rubber insulated, shielded, premium microphone cable. Type 8420 is similar, but has polyethylene insulation.

Type 8415 microphone cable has four conductors of AWG 23 stranding. It is rubber insulated, but is not shielded.

Belden Mfg. Co.

Booth 24

Audio sweeping oscillator 114

Sona-Sweep model M provides a complete measurement system, including both narrow and wide sweep widths, built-in audio detector, logarithmic and linear frequency sweeps, calibrated CW output, crystal-stabilized, pulse-type, frequency markers, and a built-in precision step attenuator.

Kay Electric Co.

Booth 25

(Continued on page 90)

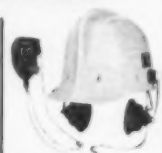


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- Crystal-controlled transmitter
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- For any single frequency between 20-55 mc., A.M.
- No license required on 27 mc. units.



MODEL HR
Hardhat with built-in transceiver, antenna, earphones and mike. High and low noise level models available.



MODEL BR
Belt-clip transceiver and headset with built-in antenna, earphones and mike. High and low noise level models available.

Let Seiscor Engineers analyze your short-range communications problems. Example: Special units have been designed into protective clothing for crash-crow fire fighters.

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FERRITRONICS LTD. is a Canadian Company which supplies the Electronic Communications' Industry with products of novel design, based on the use of Ferrites.

The use of Ferrite pot cores, which ensure easily adjustable High Q LC Resonators with practically no leakage, permit production of miniaturized Electric Wave Filters and associated networks at reduced cost. Through the use of a new, simple method of temperature compensation, greatly improved frequency stability over extended temperature ranges is achieved.

In addition, the high permeability of Ferrite cores has, for the first time, permitted the design and manufacture of extremely simple Pulse and Wide Band R.F. Power Transformers that are flat within a frequency ratio of up to 1000/1 with frequency limits up to 100 mcs.

FERRITRONICS LTD., offer you the benefits of many years of Professional Engineering experience. Our Engineering Staff have been working with Ferrites for the past ten years.

In order to prevent unnecessary loss of time in answering inquiries, complete and accurate requirement data are essential.

To enable us to suggest the most efficient and economical design to fit the application, write for a specification check list without obligation.

FERRITRONICS LIMITED,
157 Willowdale Avenue,
Willowdale, Ontario, Canada

New products at the show

Printing machine 115

Rejafix 555, Mk II high speed rotary printing machine is designed for marking and printing cylindrical articles, either straight-sided or slightly tapered, made of many different materials. Diameters from 3/16 inch up to 1 1/4 inch can be accommodated. Lengths may be up to 5 inches on the standard machine, but longer articles can be handled with the aid of special guides. Direct printing with rubber stereotypes is used on this machine.

Barnard Stamp & Stencil Ltd. Booth 32

Sonic spectrum analyzer 116

Panoramic Radio Products sonic spectrum analyzer model LP-1A "quick-look" helps locate and evaluate discrete or random signals by scanning the entire spectrum logarithmically from 40 cps to 20 kc. Once every second it automatically separates, measures and plots the frequency and voltage of waveform components on the calibrated X and Y axes, respectively, of a long persistence 5 in. CRT.

For very detailed analysis, linear segments 40 to 5000 cps wide, centerable between 0 and 20 kc, may be magnified on the screen.

Whittaker Electronics Ltd. Booth 46

Sine wave inverters 117

Power Sources, Inc., Sineverter solid state sine wave inverters offer complete



protection against short circuit, open circuit or overload. Input voltages (dc) for the four models are: PS3200 (23.5-28.5 volts), PS3201 (23.5-28.5 volts), PS3202 (47-58 volts), PS3210 (105-130 volts). Sine wave output voltage of all four model is 117 volts, 60 cps, $\pm 1\%$. Output power (kva) is 0.25, 0.50, 1.0 and 1.0 respectively.

E. G. Lomas

Booth 45

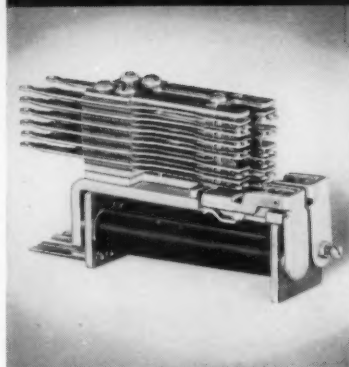
Oscilloscope with plug-ins 118

Analab type 1100/700 oscilloscope is a combination of the type 1100 cathode ray tube indicator unit and the type 700 dual-channel plug-in. The type 1100 has identical X and Y amplifiers and frequency response in dc to 500 Kc, ± 3 db. Sensitivity is 40 mc/cm; 400 mv

Stromberg-Carlson

"TELEPHONE QUALITY"

Relays



... available immediately for any part of your operation that depends on electromechanical switching.

Proven by many years of meeting the exacting requirements of the telephone industry, these twin-contact relays of unsurpassed reliability are available in many types. The following are representative:

Type A: general-purpose relay with up to 20 Form "A" spring combinations. This relay is excellent for switching operations.

Type B: a gang-type relay with up to 60 Form "A" spring combinations. **Type BB** relay accommodates up to 100 Form "A" springs.

Type C (illustrated): two relays on the same frame. A "must" where space is at a premium.

Type E: has the characteristics of Type A relay, plus universal mounting arrangement. Interchangeable with many other makes.

Complete details and specifications on all Stromberg-Carlson relays are contained in our *new relay catalog*. Contents include: spring combinations, table of equivalents, contact data, variations and special features, plus complete mounting and cover information.

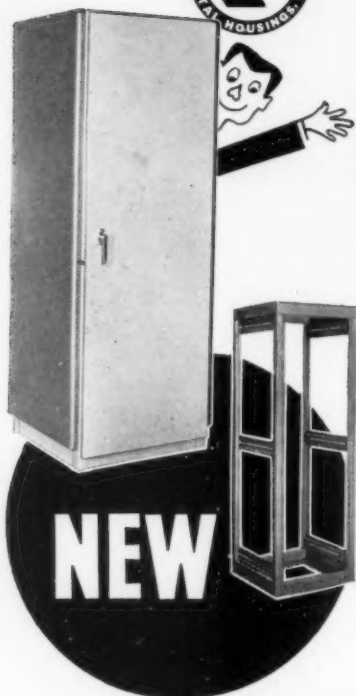
The catalog is available on request.

Exclusive Canadian Representatives.

HACKBUSCH ELECTRONICS LIMITED 23 Primrose Ave., Toronto 4



a division of General Dynamics Corporation



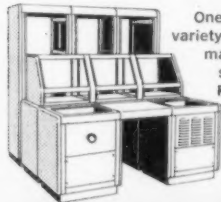
NEW

PREM-O-RAK BALL-CORNERED MODULAR TRANSMITTER RACKS

22" and 25½" DEEP FOR
STANDARD 19" RACK PANELS

Designed for MULTIPLE INSTALLA-
TIONS and for use with PREM-O-RAK
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RIGIDLY CONSTRUCTED • Frame made
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One of the unlimited
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standard, flexible
Prem-O-Rak units

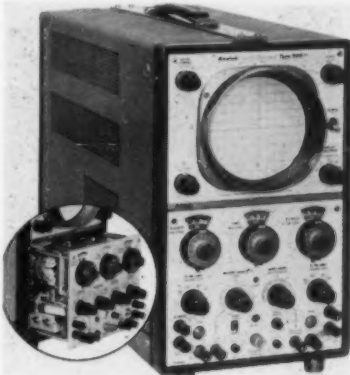
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5810 SMART AVENUE, MONTREAL

full scale.

The type 700 dual-channel plug-in
with null readout of amplitude and time
has a sensitivity of 100 uv/cm; 1 mv
full scale (10 cm) with full bandwidth.



Amplifiers are calibrated from 1 mv full
scale to 200 v full scale with 17 steps.
Sweep speeds are calibrated from 1
usec/cm to 50 sec full scale with 5 to
1 calibrated expansion.

Radionics Ltd.

Booth 17

Wire spring relay 119

Series WQA wire-spring relays are
designed to transfer up to 50 circuits
quickly for 100 million or more opera-
tions without adjustment. A card, acti-
vated by armature movement, operates
all moving wire-spring contacts simul-
taneously and independently. The move-
able springs are aligned and anchored
in a molded assembly, and the station-
ary springs are aligned by a plastic
comb.

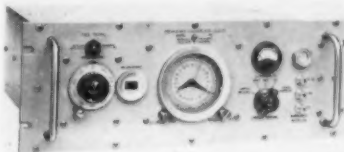
The WQA is available in one, two, or
three levels of contact assemblies, with
up to 17 Form C combinations each.
Other forms may be obtained by special
order. Operating voltages range from 6
to 220 v DC. The largest contact pile-up
(51) requires less than 4 watts operating
power.

Automatic Electric Sales
(Canada) Ltd.

Booth 4

Frequency divider and clock 120

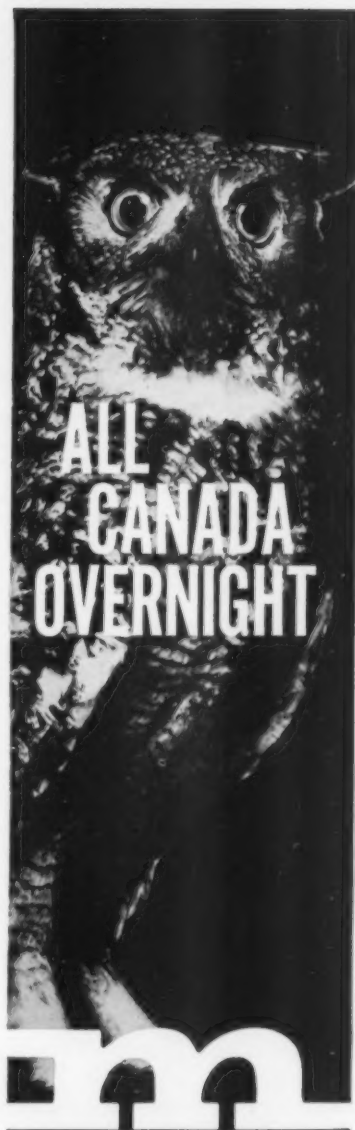
Hewlett-Packard model 113AR fre-
quency divider and clock permits adjust-
ment of frequency or time standards for
greater absolute accuracy by affording
more precise time comparisons with



standard time signals broadcast by
WWV and other stations. The 10 usec
time comparison capability of the 113-
AR results primarily from the use of
(1) a directly calibrated precision re-
solver as a time reference control, and
(2) a jitter-free optical gating system.

Atlas Instrument Corp. Ltd. Booth 11

(Continued on page 92)



MILGRAY DELIVERS TEXAS INSTRUMENTS SEMICONDUCTORS TOMORROW!

Off-the-shelf delivery in
quantities of 1 to 999 at factory
prices. TI Semiconductors arrive
faster from:

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REctor 2-4400—TWX NY1-4013—
FAX-FQF Zenith numbers in leading
industrial areas.

For further information mark No. 65



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MODERN DESIGN IMPROVES END PRODUCT APPEARANCE

Now, General Electric's BIG LOOK panel meter styling can help improve the appearance of your switchboards, panels and other equipment. BIG LOOK styling is the result of careful planning, development and field testing. It represents more than 28 years of General Electric leadership in creative panel meter design.

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INDUSTRIAL PRODUCTS DEPARTMENT
CANADIAN GENERAL ELECTRIC
COMPANY LIMITED

448W-260

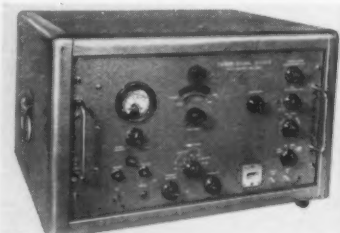
For further information mark No. 31

New products at the show

Sweep signal generator

121

FXR, Inc. sweep signal generator model X775A has agc which provides a means of measuring the reflection coefficient of microwave components by direct oscilloscope presentations. The RF power source of the instrument is an electronically-swept permanent magnet type two tube. A built-in agc amplifier can be used with an external detector to provide an almost flat reference source (± 0.5 db) over the frequency range from 8.2 to 12.4 Gc. In this manner reflectometer measurements can be made without the use of a ratio meter. Output power is adjustable continuously from 0 to 20 mw, minimum,



and the resolution or sweep rate is adjustable continuously from 0.3 to 300 Gc.

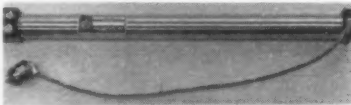
Radionics Ltd.

Booth 17

UHF amplifier

122

Huggins Laboratories, Inc. UHF-band amplifier type HA-58 is electrostatically focused and has an output of 1 watt.



This tube won an award for Industrial design at the 1960 Wescon show.

Radionics Ltd.

Booth 17

Fasteners

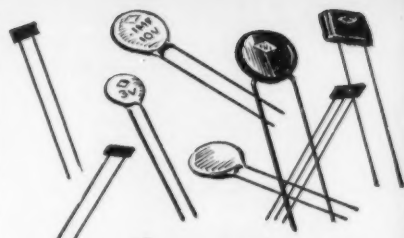
123

Series 12F sub-miniature quarter-turn fasteners have been designed for use where clearances are extremely limited. Receptacle is only 0.285 in. wide, 0.680 in. long, and 0.102 in. high. They can be used to hold covers, panels, components and sub-miniature assemblies.

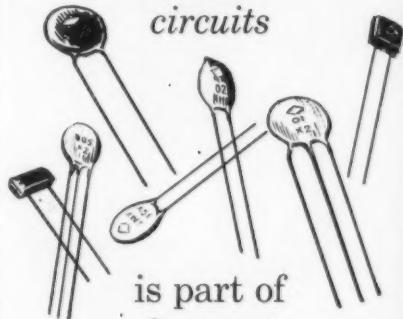
Camloc Fastener Corp.

Booth 42

Don't miss this opportunity of hearing Dr. R. L. McFarlan, president of IRE for 1960. He will be guest speaker at the IRE Communications Symposium luncheon, Friday, Nov. 4, Queen Elizabeth Hotel, Montreal.



the most complete line of ceramic capacitors for transistor circuits



is part of the most complete line of ceramic capacitors

Centralab

available for fast local delivery in industrial quantities at factory prices from your Centralab industrial distributor

Write to CENTRALAB for the names of our industrial distributors in your area. They carry the full line of CENTRALAB ceramic capacitors—high voltage, buffers, trimmers, feed-thrus, temperature compensating—as well as low voltage units for transistor circuits.

Centralab Canada Ltd.

P.O. BOX 400, AJAX, ONTARIO

For further information mark No. 38

CANADIAN ELECTRONICS ENGINEERING OCTOBER 1960

Storage oscilloscope

124

Skiatron storage oscilloscope model SK1001 is a general purpose laboratory oscilloscope with storage capabilities. Recurrent or transient signals are stored on the Skiatron Dark Trace tube. Frequency response of the vertical channel is DC to 10 kc, ± 3 db. Deflection factor at full gain is 33 mv/cm. Frequency response of the horizontal channel is DC to 10 kc, ± 3 db, and deflection factor at full gain is 0.5 volts per cm.

Whittaker Electronics Ltd. Booth 46

Noise source

125

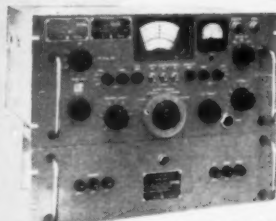
Therma-Node noise source generates noise by heating a resistive element. The element is contained in the noise head and is heated to 2200 K, generating sufficient noise power to provide noise-figure measurements up to 10 db at an accuracy of ± 0.1 db over a frequency range of 1 kc to 1000 Mc. Available as an optional extra is an interchangeable, low frequency noise head covering the range of 1 kc to 400 Mc.

Kay Electric Co. Booth 25

(For more news of products see page 94)



AN/URA-23A



SBE

OCDM APPROVED
ITEM T-32, T-32 CW, T32 SSB
BULLETIN 195C

TRANSMITTING MODE SELECTOR

The TMC Model SBE, Transmitting Mode Selector, is a universal exciter permitting the transmission of any intelligence on Single or Double Sideband, with or without carrier. 2 to 32 mc., continuous band-switched. Transmission may be simultaneous or independent of intelligence on either upper or lower sideband.



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ONTARIO, CAN.

NOW in 50 WATTS for MINIATURE and SUBMINIATURE PRODUCTION SOLDERING JOBS

the NEW, American Beauty BANTAM "X" series



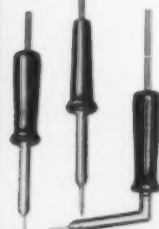
1/8" TIP

Designed with 50 watt input, these fine soldering irons will give greater productivity and do industry's most exacting soldering jobs easier, faster, better. SLOTTED STAINLESS STEEL CASINGS MAKE THE HANDLES REALLY COOL, ending operator complaints. There's no waiting or fumbling with these light, flexible tools — they're always ready. American Beauty soldering irons are known the world over for their dependability, durability and efficiency. Learn more about these fine soldering tools today.

YOU CAN'T BEAT A SOLDERED CONNECTION

WRITE FOR DESCRIPTIVE CATALOG SHEET, FORM NO. 222-C7

Shown below are other shapes and tip-size irons available in the BANTAM "X" series.



204-B

AMERICAN ELECTRICAL HEATER COMPANY
DETROIT 2, MICHIGAN

For further information mark No. 12 on Readers' Service Card

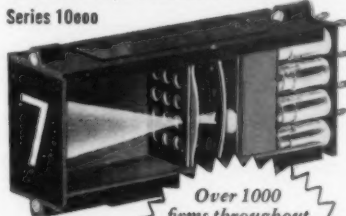
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ANY ANGLE

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DIGITAL
READOUT

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Series 10000



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SPECIFICATION HIGHLIGHTS

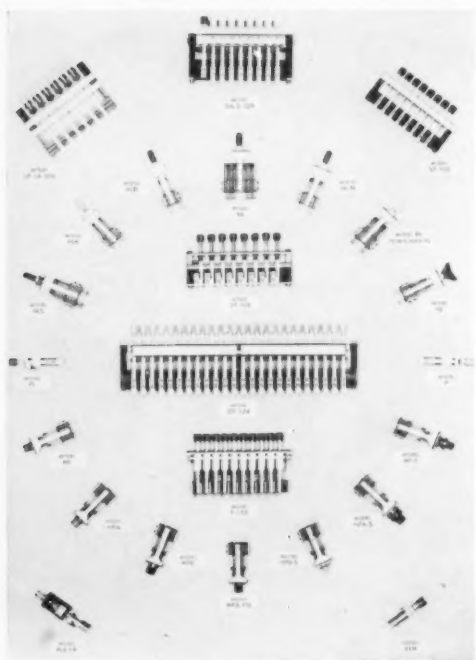
| Model | Output Range DC | | Regulation | | | | Ripple | Price |
|----------------|-----------------|------|------------------|--------|-----------|--------|--------|--------|
| | Volts | Amps | Line | | Load | | mv RMS | |
| 121 | 0.1-15 | 0-5 | ±0.01% or | 3 mv | ±0.01% or | 3 mv | .5 | \$475. |
| 122 | 0.1-36 | 0-3 | ±0.01% or | 3 mv | ±0.01% or | 3 mv | .5 | 495. |
| 123 | 0.1-50 | 0-2 | ±0.01% or | 3 mv | ±0.01% or | 3 mv | .5 | 510. |
| 124 | 0.1-50 | 0-5 | ±0.01% or | 3 mv | ±0.01% or | 3 mv | .5 | 645. |
| Also Available | | | | | | | | |
| 101 | 0-8 | 0-2 | ±0.25% or ±25 mv | | | | 1 | 195. |
| 102 | 0-14 | 0-1 | ±0.1% or | ±10 mv | ±0.1% or | ±10 mv | 1 | 190. |
| 103 | 0-30 | 0-5 | ±0.1% or | ±10 mv | ±0.1% or | ±10 mv | 1 | 190. |
| 104B | 0-50 | 0-1 | ±0.1% or ±10 mv | | | | 1 | 375. |
| 105 | 0-50 | 0-25 | ±0.25% or ±25 mv | | | | 2 | 205. |
| 112 | 0-14 | 0-2 | ±0.1% or | 10 mv | ±0.1% or | 10 mv | 1 | 240. |
| 113 | 0-30 | 0-1 | ±0.1% or | 10 mv | ±0.1% or | 10 mv | 1 | 240. |

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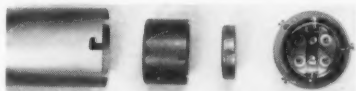
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New products—cont.

Crystal oven 126

Crystal oven type C-PSA-101 employs the advantages of the snap action thermostat in a multiple cavity design capable of precise temperature control and having the following features: Temperature cycling, ± 0.05 deg. C maximum from -55 C to within 15 C of operating temperature; Control temperature slope—change in control temperature is



less than 0.003 C per degree C change in ambient; Maximum demand power is 10 watts; Warmup is less than 20 minutes at -55 C with 10 watt heater.

Croven Ltd., Whitby, Ont.

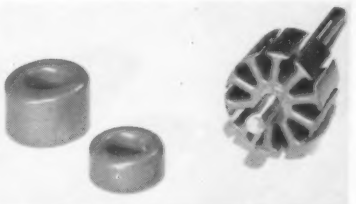
Miniature connectors 127

Min Rac 17 is a new family of miniature rack and panel, cable to chassis and cable connectors. They use modified Poke Home contacts, allowing fast solder or crimp assembly of contacts to leads outside the connector, and removal or replacement in the event of changes of circuitry. Temperature range is 0 F to 230 F; current rating is 5 amps, available with 9, 15, 25, 37 or 50 contacts.

Amphenol Canada Ltd., Toronto.

Fluidizing powder 128

Hysol 4517 epoxy fluidizing powder has been developed for insulating and coating metal parts such as meter coils. The material, when applied in a vibrator, provides a fast, economical



method of building up a substantial thickness (10 mils nominal) of insulation.

Hysol (Canada) Ltd., Toronto.

Time base and dc amplifier 129

HRT-1 time base provides seven rates of sweep voltage for use with X-Y plotters. Rates are available from 0.5 millivolts per second to 50 millivolts per second with 2% accuracy, which corresponds to 2 seconds to 200 seconds for 100 millivolts. By resetting the recorder attenuator sweep, rates may be reduced to 1,000 seconds, with some loss in linearity.

By rotating the panel selector to DC Amp, the unit becomes a multi-purpose chopper stabilized dc amplifier. It can also be used with X-Y recorders as a primary low level preamplifier or with galvanometer 0-1 ma recorders.

B. H. McGregor, Toronto.

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ELECTRONICS... INDUSTRY'S TOOL OF THE FUTURE

"What's ahead for electronics in Canadian industry?" ... "What are the problems in selling new techniques?" ... "What are the economic factors faced by the user?"

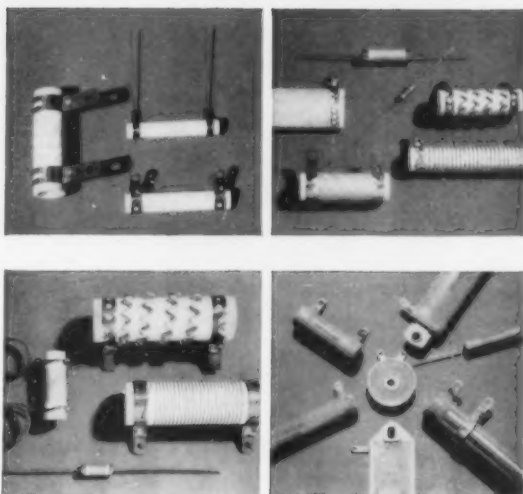
In its December issue, Canadian Electronics Engineering will attempt to answer these questions. Authoritative, well-illustrated articles written by leaders in Canadian industry will review available knowledge, report on most recent developments and peer into the future.

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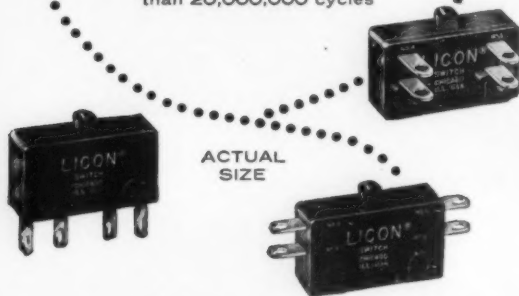
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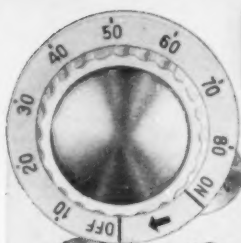
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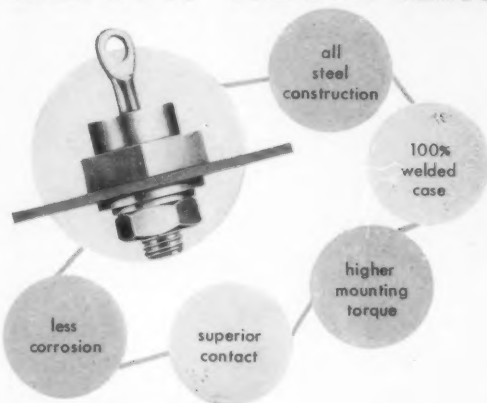
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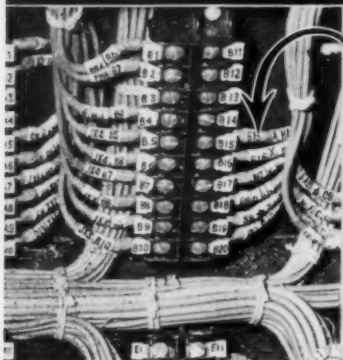
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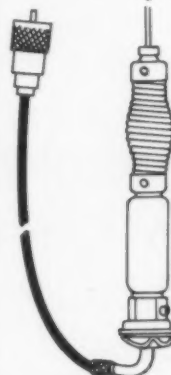
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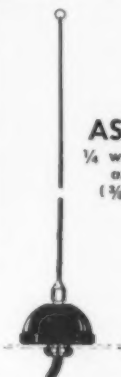


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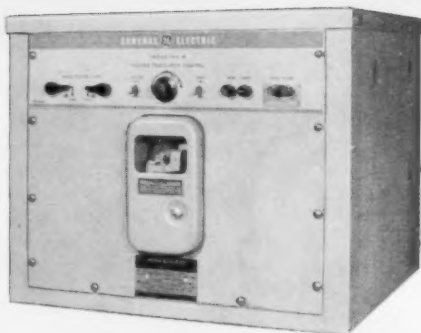
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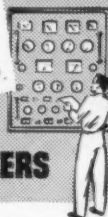


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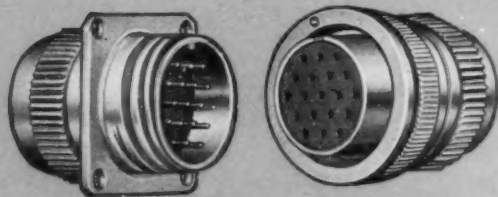
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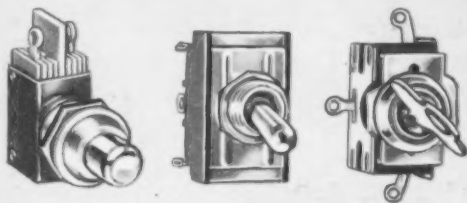


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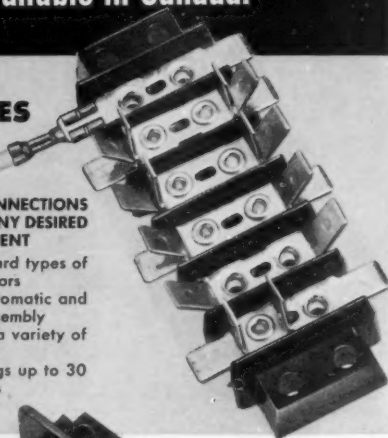
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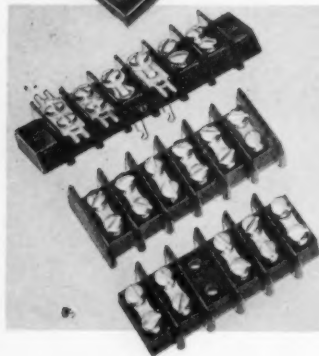
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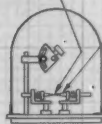
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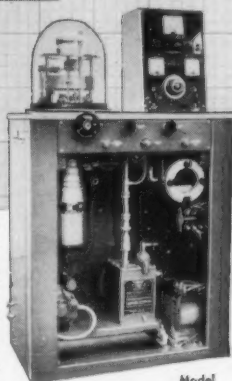
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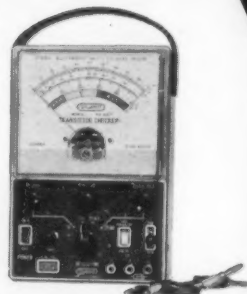
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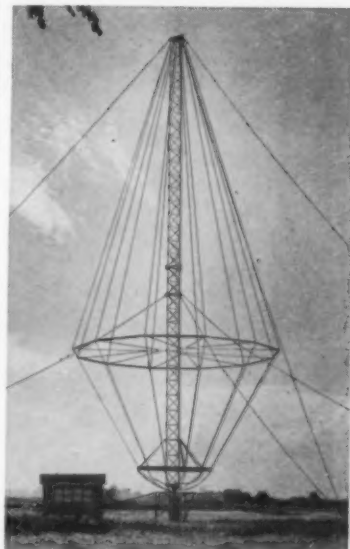
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| KEY NO. | A | PAGE NO. | KEY NO. | J | PAGE NO. |
|---------|---|----------|---------|--|----------|
| 11 | Alden Products Company | 4 | 59 | Jerrold Electronics Corp. | 89 |
| 12 | American Electrical Heater Company | 93 | | K | |
| 13 | Ampex of Canada Limited | 78-79 | 60 | Kelk, Limited, George | 95 |
| 14 | Andrew Antenna Corp. Ltd. | 34 | | L | |
| 15 | ARCO Electronics Inc. | 25 | 61 | Lafayette Radio (Industrial Electronics Div.) | 99 |
| 16 | Arnold Engineering Co., The | 31 | | M | |
| 17 | Arrow-Hart & Hegeman (Canada) Ltd. | 101 | 62 | Marsland Engineering Co. Ltd. | 24 |
| 18 | Astral Electric Co. Ltd. | 97 | 63 | McCurdy Radio Industries Ltd. | 2 |
| 19 | Atlas Instrument Corp. | 19 | 64 | Microwave Systems | 84 |
| 20 | Automatic Electric Sales (Canada) Ltd. | 50 | 65 | Milgray Electronics | 91 |
| 21 | Aviation Electric Ltd. | 101 | 66 | Minnesota Mining & Mfg. of Canada Ltd. | 26 |
| | B | | 67 | Muirhead Instruments Ltd. | 87 |
| 22 | Bach Simpson Ltd. | 80-81 | | N | |
| 23 | Beatty Bros. Limited | 80 | 68 | Northern Electric Co. Ltd. | 17 |
| 24 | Belden Mfg. Co. | 22 | 101 | Northern Electric Co. Ltd. | 27 |
| 18 | Belling & Lee Ltd. | 97 | | O | |
| 26 | Boston Insulated Wire & Cable Co. Ltd. | 97 | 69 | Ohmite Mfg. Company | 98 |
| 27 | Burndy Canada Ltd. | 33 | | P | |
| 28 | Burton Rogers Company | 100 | 70 | Payette Radio | 99 |
| | C | | 71 | Philco Corp. of Canada Ltd. | 28 |
| 29 | Canada Illinois Tools Ltd. (Licon Switches) | 96 | 72 | Philco Corp. of Canada Ltd. | 49 |
| 30 | Canada Wire & Cable Co. Ltd. | 29 | 73 | Philips Electronics Industries Ltd. | 14-15 |
| 31 | Canadian General Electric Co. Ltd. (Industrial Products Division) | 92 | 74 | Potter & Brumfield Canada Ltd. | 41 |
| 32 | Canadian General Electric Co. Ltd. (Apparatus Division) | 100 | 75 | Premier Metal Housings Ltd. | 91 |
| 33 | Canadian Marconi Company | 21 | 76 | Prentice-Hall, Inc. | 86 |
| 34 | Canadian Westinghouse Co. Ltd. (Electronics Division) | 39 | 77 | Pye Canada Limited | 98 |
| 35 | Canadian Westinghouse Co. Ltd. (Electronic Tube Division) | 18 | 78 | Pylon Electronic Development Co. Ltd. | 101 |
| 36 | Cannon Electric Canada Ltd. | 47 | | Q | |
| 37 | Capitol Machine Company | 94 | 79 | Quan-Tech. Labs. | 94 |
| 38 | Centralab Canada Ltd. | 92 | | R | |
| 39 | C. P. Clare Canada Ltd. | 8 | 80 | R-O-R Associates Ltd. | 88 |
| 40 | Clark, Ltd., Alex L. | 42 | 81 | Railway & Power Engineering Corp. Ltd. (Electronics Campaign) | 23 |
| 41 | Collins Radio Co. of Canada Ltd. | 32 | 82 | Railway & Power Engineering Corp. Ltd. (Lord Electronic Div.) | 38 |
| 42 | Comar Electric Company | 99 | 83 | Raytheon Canada Ltd. | 6 |
| 43 | Croven Limited | 3 | 84 | Rogan Bros. | 96 |
| | D | | 85 | Rogers Electronic Tubes & Components (Division of Philips Electronics Industries Ltd.) | 43 |
| 44 | Decca Radar (Canada) Ltd. | 16 | | S | |
| | E | | 86 | Sanborn Company | 30 |
| 45 | Edwards High Vacuum (Canada) Ltd. | 102 | 87 | Sigma Instruments Inc. | 85 |
| 46 | EICO | 93 | 88 | Sinclair Radio Laboratories Ltd. | 98 |
| 47 | Eitel-McCullough Inc. | OB | 89 | Sola-Basic Products Ltd. | 46 |
| | F | | 90 | Southco Division, South Chester Corp. | 40 |
| 48 | Ferritronics Limited | 90 | 91 | Standard Telephone & Cables Mfg. Co. (Canada) Ltd. | 35 |
| | G | | 92 | Stark Electronic Instruments Ltd. | 102 |
| 49 | Guardian Electric Mfg. Co. | 36 | 93 | Syntro (Canada) Ltd. | 96 |
| | H | | | T | |
| 50 | Hackbusch Electronics Ltd. | 90 | 94 | T. M. C. (Canada) Ltd. | 93 |
| 51 | Hammond Mfg. Co. Ltd. | 20 | 95 | Terminal Radio International Inc. | 89 |
| 52 | Heinemann Electric Company | 45 | | U | |
| 53 | Hellermann Canada Ltd. | 97 | 96 | United-Carr Fastener Co. of Canada Ltd. | 102 |
| 54 | Hewlett-Packard Company | IBC | 102 | United Shoe Machinery Co. of Canada Ltd. | 37 |
| 55 | Honeywell Controls Ltd. | 10-11 | | V | |
| 28 | Hoyt Electrical Instrument Works | 100 | 97 | Varian Associates of Canada Ltd. | IFC |
| | I | | | W | |
| 57 | Industrial Electronic Engineers Inc. | 93 | 98 | Ward Leonard of Canada Ltd. | 95 |
| 58 | International Business Machines Co. Ltd. | 12-13 | 99 | Wholesale Radio & Electronics Ltd. | 100 |
| | | | 100 | Wind Turbine Co. of Canada Ltd., The | 103 |

Defence school graduates first electronics trainees

The first class of electronic specialists graduated in August from the training course organized by the Defence Systems Service Division of Burroughs Adding Machine Co. of Canada, Ltd., Toronto. All seventeen graduates are now at RCAF station Edgar, near Barrie, Ont., installing a Burrough's data processing and computer system.

Similar installations will be made at 31 other radar sites, all of which form part of CADIN, the Canadian extension of the North American air defence system.

Men from the first class of graduates will form the nucleus of a service group expected to eventually number 356.

A special achievement award went to Jim Aiken of Toronto, top man in the graduating class.



J. L. Rapmund (left), general manager of Burroughs Adding Machine of Canada Ltd., presents special achievement award to J. Aiken, top student. With them is E. H. McKeown, head of Defence Systems Service Division.

IRE Section meetings

Kitchener-Waterloo: Oct. 17: "Some control aspects of Canada's first large-scale nuclear generating station," by F. M. Foulks, Atomic Energy of Canada, Ltd.; University of Waterloo, 8.15 p.m.

Toronto: Oct. 24: "A bright radar display for air traffic control," by Dr. T. W. R. East, Raytheon Canada Ltd.; Hart House, 7 p.m. Nov. 3: "The use of microwave to support a high altitude platform," by Dr. R. L. McFarlan, president of IRE. Dr. McFarlan is also prepared to answer any questions on IRE policies and practices, a subject that never fails to provide

stimulating conversation with president McFarlan; Hart House, 7 p.m. (For more news, see page 52.)

Montreal hi-fi show

The 1960 Montreal High Fidelity Exposition, the second Canadian show to be held this year under the auspices of the Dominion High Fidelity Association, will be staged in the Sheraton Mount Royal Hotel, October 12-15.

Fifty or more exhibits of high fidelity and stereophonic equipment will be housed in individual rooms on the first floor of the hotel and will be open to the public from 11.30 a.m. to 10.00 p.m. daily. An admission charge of fifty cents is made and it is anticipated the attendance will reach the nine thousand mark.

All equipment shown and demonstrated is required to meet qualifications adopted by the association.

Call for papers

Do you have a new engineering development you want to talk about? Maybe one of these meetings will be the place.

1961 IRE International Convention, New York, March 20-23, 1961. Prospective speakers should send a 100-word abstract in triplicate, title of paper, name and address; a 500-word summary in triplicate, title of paper, name and address; an indication of the technical field in which the paper falls. Send these to Dr. G. K. Teal, Institute of Radio Engineers, Inc., 1 East 79th Street, New York 21, N.Y. Deadline is Oct. 21, 1960.

1961 Winter Convention on Military Electronics, Feb. 1-3, 1961, Los Angeles, Calif. Send 100-word abstracts and 500-word summaries to Dr. J. J. Myers, Hoffman Electronics Corp., Military Products Div., 3717 S. Grand Ave., Los Angeles 7, Calif. Deadline is Nov. 15, 1960.

Second Symposium on Engineering Aspects of Magnetohydrodynamics, University of Pennsylvania, Philadelphia, March 9-10, 1961. Abstracts of papers should be sent to the following session chairmen not later than Nov. 15, 1960. Communications and diagnostics: C. B. Wharton, Lawrence Radiation Laboratory, Livermore, Calif. Flight applications: Dr. G. S. Janes, Avco Research Laboratories, Everett, Mass. Fusion: Dr. C. W. Little, Atomic Energy Div., Allis-Chalmers Mfg. Co., Milwaukee 1,

Wis. Power conversion: Dr. G. W. Sutton, General Electric Co., Missile and Space Vehicle Dept., Philadelphia 24, Pa.

COMING EVENTS

October

12-15 Montreal High Fidelity Exposition, Sheraton Mount Royal Hotel, Montreal.

13-14 1960 International Symposium on Engineering Writing and Speech, Hotel Bismark, Chicago.

17-19 Symposium in Adaptive Control Systems, IRE Garden City, L.I.

26-27 Computer Applications Symposium, Armour Research Foundation, Morrison Hotel, Chicago.

26 Central Canada Broadcasters Association, Engineering Conference, King Edward Sheraton Hotel, Toronto.

Oct. 31-Nov. 2 Conference of Electrical Techniques in Medicine & Biology, Sheraton Park Hotel, Washington, D.C.

November

4-5 IRE Symposium on Communications sponsored by the Montreal Section of IRE, Queen Elizabeth Hotel, Montreal.

8-9 Symposium on Space Instrumentation, IRE, Washington, D.C.

9-11 Power Industry Computer Application Conference, Chase Hotel, St. Louis, Mo.

21-25 2nd Industrial Photographic and Television Exhibition and Conference, Royal Albert Hall, London, England.

Defence production sharing

In August, 1959, CEE presented a feature issue on integrated defence production. Next month CEE will present a status report showing what has happened during the past year, then take a look at what can be expected during the coming year. Included will be feature articles on reciprocal approval agreement for qualification of electronic parts, and preparation of instruction manuals on production sharing contracts.

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If you are going to the IRE Communications Symposium, use the advance registration and hotel reservation cards to save time and money.

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| 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 |
| 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 |
| 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |
| 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | 101 | 102 | 103 | 104 | 105 |
| 106 | 107 | 108 | 109 | 110 | 111 | 112 | 113 | 114 | 115 | 116 | 117 | 118 | 119 | 120 |
| 121 | 122 | 123 | 124 | 125 | 126 | 127 | 128 | 129 | 130 | 131 | 132 | 133 | 134 | 135 |
| 136 | 137 | 138 | 139 | 140 | 141 | 142 | 143 | 144 | 145 | 146 | 147 | 148 | 149 | 150 |
| 151 | 152 | 153 | 154 | 155 | 156 | 157 | 158 | 159 | 160 | 161 | 162 | 163 | 164 | 165 |
| 166 | 167 | 168 | 169 | 170 | 171 | 172 | 173 | 174 | 175 | 176 | 177 | 178 | 179 | 180 |
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Friday, Nov. 4
9.00 a.m. to 10.00 p.m.
Saturday, Nov. 5
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— tickets for luncheon
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SPECIFICATIONS

Frequency Range: 50 kc to 65 MC in 6 bands.

Frequency Accuracy: Within $\pm 1\%$.

Frequency Calibrator: Crystal oscillator provides check points at 100 kc and 1 MC intervals accurate within 0.01% from 0° to 50° C.

RF Output Level: Continuously adjustable from 0.1 μ v to 3 volts into a 50 ohm resistive load. Calibration is in volts and dbm (0 dbm is 1 milliwatt).

Output Accuracy: Within ± 1 db into 50 ohm resistive load.

Frequency Response: Within ± 1 db into 50 ohm resistive load over entire frequency range at any output level setting.

Output Impedance: 50 ohms, SWR less than 1.1:1 at 0.3 v and below.

Spurious Harmonic Output: Less than 3%.

Leakage: Negligible; permits sensitivity measurements to 0.1 μ v.

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Internal Modulation: 0 to 100% sinusoidal modulation at 400 cps $\pm 5\%$ or 1000 cps $\pm 5\%$.

Modulation Bandwidth: Dc to 20 kc maximum.

External Modulation: 0 to 100% sinusoidal modulation dc to 20 kc.

Envelope Distortion: Less than 3% envelope distortion from 0 to 70% modulation at output levels of 1 volt or less.

Spurious FM: Less than 0.0001% or 20 cps, whichever greater.

Spurious AM: Hum and noise sidebands are 70 db below carrier.

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Price: (cabinet) \$1,200.00 (rack mount) \$1,185.00.

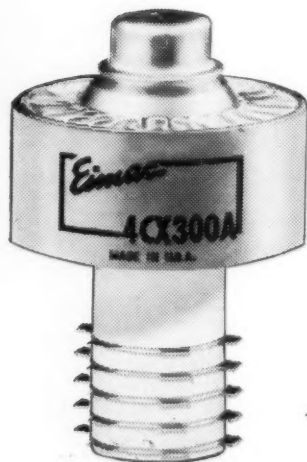
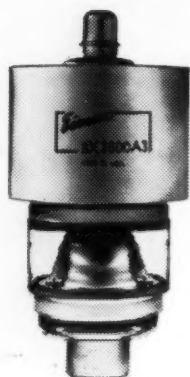
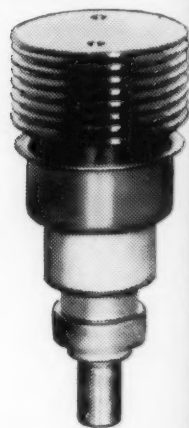
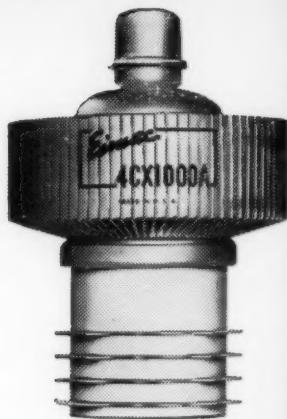
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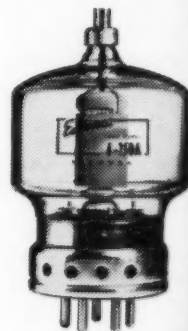
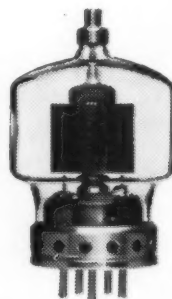
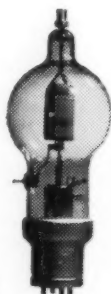
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